

The Journal of the American Association of Zoo Keepers, Inc.


AKF

Animal Keepers' Forum



Special Issue
Dedicated to
Waterfowl

November/December 2017, Volume 44, Nos. 11 and 12



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The American Association of Zoo Keepers, Inc. exists to advance excellence in the animal keeping profession, foster effective communication beneficial to animal care, support deserving conservation projects, and promote the preservation of our natural resources and animal life.

ABOUT THE COVER

This month's cover photo comes to us from Katie Lubbock of Sylvan Heights Bird Park and features an African Pygmy Goose (*Nettapus auritus*). The African Pygmy Goose is managed by AZA as a Yellow SSP. In the wild they are listed as a species of least concern by the IUCN.

While its beak is more like that of a goose, the pygmy goose is actually a type of perching duck. It is widespread throughout sub-Saharan Africa and Madagascar where they can be found dabbling in freshwater lakes, ponds, swamps, marshes, inland deltas, flood plains, slow-flowing rivers, and occasionally coastal lagoons. Despite its dramatic plumage, this species remains uncommon in zoos and private collections. These small birds live up to their name and are one of the smallest species of waterfowl in the world. They average about 12 inches long and weigh approximately 280 grams.

African pygmy geese are cavity nesters. They usually nest above water in natural tree hollows or cavities but have also been found nesting in cliff holes, termite hills, artificial nest boxes, and sometimes on the ground in clumps of grass. Pairs choose their nesting sites together. Females lay clutches of 6-12 eggs and are the only ones to sit on the nest, incubating the eggs for three to four weeks. Females then care for their young for about seven weeks after hatching, until the young fledge.

Articles sent to **Animal Keepers' Forum** will be reviewed by the editorial staff for publication. Articles of a research or technical nature will be submitted to one or more of the zoo professionals who serve as referees for **AKF**. No commitment is made to the author, but an effort will be made to publish articles as soon as possible. Lengthy articles may be separated into monthly installments at the discretion of the Editor. The Editor reserves the right to edit material without consultation unless approval is requested in writing by the author. Materials submitted will not be returned unless accompanied by a stamped, self-addressed, appropriately-sized envelope. Telephone, fax or e-mail contributions of late-breaking news or last-minute insertions are accepted as space allows. Phone (330) 483-1104; FAX (330) 483-1444; e-mail is shane.good@azak.org. If you have questions about submission guidelines, please contact the Editor. Submission guidelines are also found at: azak.org/akf-submission-guidelines/.

Deadline for each regular issue is the 3rd of the preceding month. Dedicated issues may have separate deadline dates and will be noted by the Editor.

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While I was in Uganda the AAZK Board worked to create a framework for an expanded Board with four new members and new oversight responsibilities.

This year I had to miss the conference. I heard it was a wonderful conference and our "greenest" one yet! I was missing with good reason though. I was with the Giraffe Conservation Foundation (GCF), AAZK's newest conservation partner, in Uganda at the time! A big thank you to Disney's Animals Science and Environment for sending myself and a fellow co-worker/AAZK member, Melaina Newcomer, to help in the field with Operation Twiga II. Operation Twiga II was an undertaking in collaboration with the Uganda Wildlife Authority (UWA), GCF and other partners to set about boosting the recently established Nubian giraffe population in the southern part of Murchison Falls National Park. This August while you were at conference I was able to be a part of translocating 9 of the 19 giraffe that were translocated from the northern to the southern side of the park. This translocation also allowed for a lot of scientific study to be done on wild giraffe. AZA partners from Cheyenne Mountain Zoo, Colorado State University, Columbus Zoo and Cleveland Metroparks Zoo, ELPO and Living Desert all had their hands in on getting data to help in the husbandry of captive giraffe. This data included taking blood, getting skin biopsies, and hoof radiographs. After Operation Twiga II, Melaina and I were able to train guides to monitor 4.11 Nubian giraffe in Lake Mburu. It was an unforgettable experience to be part of such a collaboration between zoos, higher education, local conservation stewards (UWA), and now a current AAZK Conservation Partner.

An AAZK Conservation Partner is defined as: Any group established for the sole purpose of conserving animal species, animal habitat or for promoting the value of education of exotic animal keepers. AAZK has over 20 Conservation Partners (CPs). We have our Bowling for Rhinos CPs which are Lewa Wildlife Conservancy, International Rhino Foundation, and Action for Cheetahs in Kenya. We also have a CP connected to our Trees for You and Me Program which is Polar Bears International. Please check out our other CPs at: <https://www.aazk.org/links/conservation-partners/>.

While I was in Uganda the AAZK Board worked to create a framework for an expanded Board with four new members and new Oversight responsibilities. As Vice President I will be point of contact for new Board members Azzara and Paul and veteran Bill. Azzara is now Oversight to the Conservation Team and Paul has taken on the Regulation Team. There are great projects on the horizon for each of them. One of Azzara's and the Conservation Committee's new projects is taking on being point for AAZK's Conservation Partners. Paul and the Behavioral Husbandry Committee (BHC) are in the home stretch revising the AAZK Enrichment notebook. Our veteran BOD member, Bill Steele, now Oversight for the Recognition Team is in the process of streamlining AAZK's available Awards and Grants!

Thank you for your membership and please help me welcome the Board Members into their new roles.

Mary Ann Cisneros
AAZK Vice President



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COMING EVENTS

Post upcoming events here!
e-mail shane.good@aazk.org

January 22-26, 2018
Zoos and Aquariums
Committing to Conservation
Jacksonville, FL
Hosted by Jacksonville Zoo
For more information go to:
zaccconference.com/

March 24-29, 2018
AZA Mid-Year Meeting
Jacksonville, FL
Hosted by Jacksonville Zoo
and Gardens
For more information go to:
aza.org/conferences-meetings#mym

April 8-13, 2018
Animal Behavior
Management Alliance
(ABMA) Annual Conference
San Antonio, TX
Hosted by San Antonio Zoo
and Sea World San Antonio
For more information go to:
theabma.org/abma-annual-conference/

April 10 or 11, 2018
(*same workshop held each day)
Ape Cardio Health Workshop
Waco, TX
Hosted by Cameron Park Zoo
For more information contact:
orangutan@wacotx.gov

May 4-6, 2018
Recon: Reconnecting with
Elephants in Restricted
Contact.
Colorado Springs, CO
Hosted by
Cheyenne Mountain Zoo
For more information go to:
cmzoo.org/index.php/recon-elephant-workshop/

August 23-25, 2018
International Symposium
on Pangolin Care and
Conservation
Brookfield, IL
Hosted by Chicago
Zoological Society
For more information contact:
amy.roberts@czs.org

September 23-27, 2018
AZA Annual Conference
Seattle, WA
Hosted by Seattle Aquarium
and Woodland Park Zoo
For more information go to:
aza.org/conferences-meetings#mym

October 14-18, 2018
International Congress on
Zookeeping
Buenos Aires, Argentina
Hosted by Fundacion
Temaiken and the
International Congress
of Zookeepers
For more information go to:
iczoo.org/congress

October 15-20, 2018
Otter Keeper Workshop
Portland, OR
Hosted by Oregon Zoo
For more information go to:
otterkeeperworkshop.org/



October 4-8, 2018
AAZK National Conference
Denver, CO

Hosted by the Rocky Mountain
AAZK Chapter and Denver Zoo

rmaazk.org/2018-national-aazk-conference/

October 25-27, 2018
Waterfowl Conservation
Workshop
Greenville, NC
Hosted by International Wild
Waterfowl Association and
Sylvan Heights Bird Park
For more information go to:
waterfowlconservation.org

AAZK Announces 2017 Grant Winners

Professional Development, non-National AAZK Conference Related

- ▶ Rick Smith, Saint Louis Zoo \$500 for Delaware Shorebird Project
Requested \$500
- ▶ Kendall Thawley, Houston Zoo \$1000 for Giraffe Conservation Foundation Research Trip
Requested \$1000
- ▶ Victoria Miller, Houston Zoo \$500 for Painted Dog Conference
Requested \$1000

Research Grant

- ▶ Lianne Thompson, Assiniboine Park Zoo \$1000 for "Implementation of an environmental enrichment program to reduce over-grooming and pacing in captive red pandas"
Requested \$1000

Professional Development, National AAZK Conference

- ▶ Joy Kotheimer, Columbus Zoo and Aquarium \$500
Requested \$500
- ▶ Christy Webster, Point Defiance Zoo and Aquarium \$500
Requested \$500

A Call for Applications for the 2018 Grants will appear in the January issue of the AKF!

Congratulations 2017 Bowling For Rhinos Trip Winners!

The top two money raisers each year are offered their choice of a two-week trip to visit Lewa in Kenya or the Indonesian Parks with IRF. #3 and 4 are awarded the two remaining trips.

1. Jill Werner from LA AAZK raised \$55,200 (a record amount)
2. Deserrai Burke from Toronto AAZK raised \$28,218
3. Charlie Hyde from San Diego AAZK raised \$25,301
4. Toni Piccolotti from Jacksonville AAZK raised \$21,517

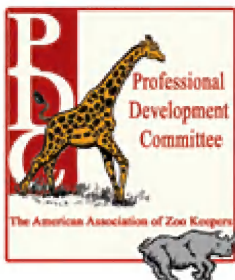
Each year, AAZK and Lewa reward an outstanding individual who has gone above and beyond in their extraordinary effort to organize BFR events. Often times, these behind-the-scenes efforts go unnoticed. It takes a great deal of effort to hold successful BFR events year after year.

Mandy Siegel is the "2017 Anna Merz Award winner" (formerly called "Honorary"). Mandy and a companion will be hosted by Lewa for 10 days in October 2018. She has been recognized for her years of dedication and perseverance organizing the Greater Baltimore Bowling For Rhinos event.

Trip winners have won trips with as little as \$850 (1995) to as much as \$55,200 in 2017. Trip winners have been from 18 DIFFERENT zoos. If we include the Anna Merz/honorary trip, that number would be 25 DIFFERENT zoos!

Thank you to everyone who participates in Bowling For Rhinos, all those who help spread the word of the plight of the rhino AND to all those who help organize the amazing variety of BFR events each year! Together we CAN make a difference in the world! Woohoo!





AAZK Professional Development Committee Second Call for Topical Workshops 2018 AAZK National Conference

**The 45th Annual AAZK National Conference
Denver, CO - October 4-8, 2018**

Conference Theme: *"Adjust Your Altitude"*

Second Call for Topical Workshops

The AAZK Professional Development Committee is pleased to announce the second call for Topical Workshops for the 2018 AAZK National Conference hosted by the Rocky Mountain Chapter of AAZK. The Host Chapter has chosen the theme **"Adjust Your Altitude"**, which will highlight innovative new ideas in the animal care profession.

Deadline for Submission of Abstracts for Workshops: January 15, 2018.

Authors will be notified regarding acceptance no later than February 15, 2018.

Workshops-Format

Workshop subjects should be in-depth explorations of animal health, animal management, taxa-specific husbandry, and keeper professional development. Workshops should be two hours in length. Subjects that require more than two hours should be submitted as "Part One" and "Part Two".

Open Topical Workshops

The Open Workshop format will offer unlimited attendance (based on the capacity of the ballroom) and will be best suited for lecture-based workshops with a Q & A session at the end.

Limited Topical Workshops – Held in limited capacity breakout rooms, this format is best suited for small group interactive workshops and will have a cap on the number of participants.

There is a **NEW PROCEDURE** for submissions this year.

How to Submit Your Abstract for Consideration:

- ▶ Go to the 2018 conference website
- ▶ Download the Application for Topical Workshops
- ▶ Fill out completely and submit to pdcaazk.org no later than January 15th, along with your workshop abstract (see below)

NOTE: If you do not use the new application, your abstract will not be reviewed.

Guidelines for Abstracts:

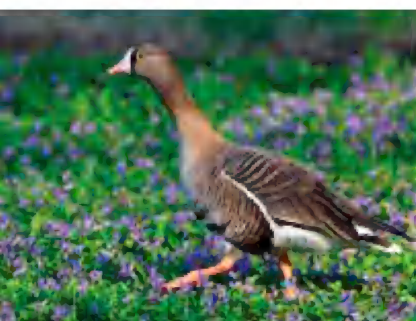
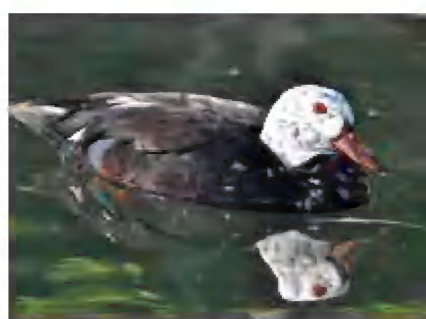
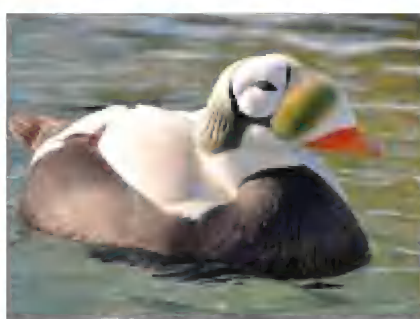
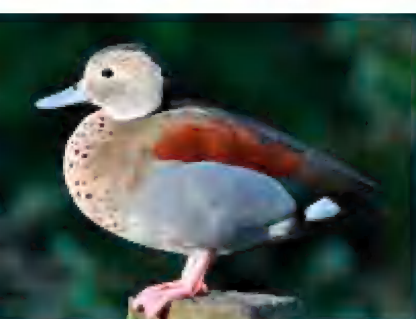
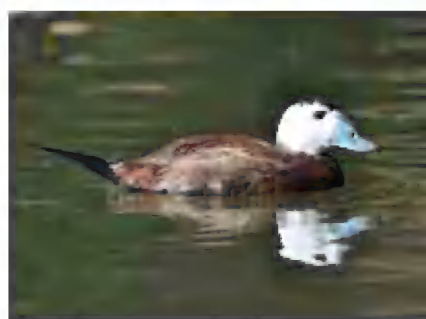
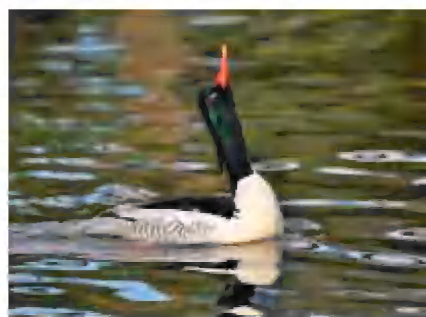
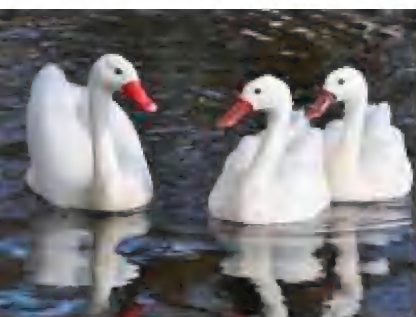
- ▶ Abstracts should be no more than 250 words and should focus on the main theme of the Workshop
- ▶ Abstracts and Applications should be submitted as a Microsoft Word® document via e-mail to: pdcaazk.org.
- ▶ File should be named **WorkshopAbstractAuthorlastname2018**

Any questions should be directed to pdcaazk.org with ATTN: Topical Workshop as part of the e-mail subject.

Thank You



**Thank You to the Sponsors of this Special Issue
of the AKF Dedicated to Waterfowl!**



Why Waterfowl?

Ian Gereg
Curator of Birds
Philadelphia Zoo

The immediate recognizability and perceived familiarity of ducks, geese and swans makes some in the zoological field hesitant to commit space to them. With exhibit space at a premium, why commit it to animals considered so run-of-the-mill? Upon digging deeper, one will not only find the birds themselves far from domestic, but the human-waterfowl relationship to be long and complex. With diversity in abundance and interesting interpretive opportunities, the waterfowl family deserves a second look. Here I propose some of the many reasons why I and many others find the waterfowl family particularly fascinating.

Appealing

The beauty of waterfowl is enjoyed by millions of birdwatchers, hunters, artists and photographers of all ages and backgrounds.

- ▶ They are colorful and flashy. Look no further than the Mandarin Duck (*Aix galericulata*) or North American Wood Duck (*Aix sponsa*) for vibrant examples of avian beauty.
- ▶ They are active and the majority of species can be found away from dense cover, making them relatively easy to locate and observe.
- ▶ Their calls have been revered by countless cultures as special music for the spirit. Noted ornithologist and artist Roger Tory Peterson wrote:
 - ▶ "Few men have souls so dead that they will not bother to look up when they hear the barking of wild geese."
- ▶ Waterfowl respond well to people, even approaching them to interact and be fed. They adapt to enclosure changes easily and are calm and content in exhibits.

Fascinatingly diverse

The waterfowl family (Anatidae) contains over 140 species in 49 genera, and the family tree is complicated and frequently changing. There are dozens of sub-species, well documented hybridization, and unresolved relationships among species.

The relationships among waterfowl have been explored through a variety of means, including their skeletal structure, courtship behavior, growth rates, and DNA. Several monotypic species, like the Ringed Teal (*Callonetta leucophrys*) and the Coscoroba Swan (*Coscoroba coscoroba*) have jumped entire branches of the family tree between taxonomic revisions.

Australia is particularly full of waterfowl oddities, including the Cereopsis Goose (*Cereopsis novaehollandiae*), Pink-eared Duck (*Malacorhynchus membranaceus*), Freckled Duck (*Stictonetta naevosa*) and the Musk Duck (*Biziura lobata*). All four of these species are so unique that scientists have a hard time identifying their relationships with other waterfowl.

Strong with impressive endurance

The feats of waterfowl impress us. The highest flying bird in the world is the Bar-headed Goose (*Anser indicus*), which can reach heights of nearly 21,120 feet during their migration over the Himalayan Mountains each year. The Long-tailed Duck (*Clangula hyemalis*) can dive to over 200 feet foraging for their underwater prey. Brant Geese (*Branta bernicla*) nest as close as 450 miles from the North Pole. A Red-breasted Merganser (*Mergus serrator*) was clocked flying at nearly 100 miles per hour!

Many species of waterfowl partake in long-distance migrations to and from their breeding grounds in the Arctic each year. In the world's arid regions, waterfowl are nomadic; flying great distances in search of suitable temporary wetland habitats.

Biological indicators and flagship species

Waterfowl are excellent indicators of overall wetland ecosystem health. They are sensitive to changes in the abundance and chemistry of water, along with the health of aquatic vegetation and invertebrates. A healthy "wetland soup" of invertebrates, algae and organic matter is the basis for a healthy ecosystem in which waterfowl are one of the largest creatures in the food web.

Because of their ecological ties to wetlands, the conservation of waterfowl habitat benefits hundreds of other plant and animal species. Aquatic plants, invertebrates, amphibians, reptiles, mammals and other groups of birds that utilize waterfowl habitats are protected by efforts to conserve them. In addition, waterfowl are particularly charismatic wetland inhabitants and can act as flagship species for entire wetland ecosystems.

Vulnerable to change

Waterfowl populations are at risk due to their diverse habitat requirements during their breeding, migration and non-breeding cycles. Removing or altering wetlands on the landscape can be devastating to local populations and force migratory species to push on in the search for suitable habitat. The impacts of climate change and human development pose a serious threat to waterfowl all over the world. Habitat loss and modification caused the near extinction of the Madagascar Pochard (*Aythya innotata*), White-winged Wood Duck (*Cairina scutulata*), Brazilian Merganser (*Mergus octosetaceus*), and Laysan Teal (*Anas laysanensis*).

Beyond changes in habitat, humans pose other threats to waterfowl. Unregulated or illegal hunting has contributed to the decline of the Baer's Pochard (*Aythya baeri*), Red-breasted Goose (*Branta ruficollis*), and the Meller's Duck (*Anas melleri*). Introduced predators like mink, mongoose and rats took their toll on Hawaiian Geese (*Branta sandvicensis*), New Zealand Blue Duck (*Hymenolaimus malacorhynchos*) and the South Georgia Pintail (*Anas georgica georgica*). Arctic nesting and marine species like the Long-tailed Duck, Spectacled Eider (*Somateria fischeri*) and Steller's Eider (*Polysticta stelleri*) are especially at risk to Arctic oil exploration and the inevitable spills that come with it.

Competition and hybridization with introduced waterfowl is also a cause for concern. The White-headed Duck (*Oxyura leucocephala*) competes for habitat and mates with feral North American Ruddy Duck (*Oxyura jamaicensis*). The Hawaiian Duck (*Anas wyvilliana*) is being inundated with hybrid blood from released Mallards (*Anas platyrhynchos*). Introduced Mallards also compete and hybridize with their cousins the Yellow-billed Duck (*Anas undulata*), Pacific Black Duck (*Anas superciliosa*), American Black Duck (*Anas rubripes*), Spot-billed Duck (*Anas poecilorhyncha*) and Meller's Duck wherever they are allowed to invade.

Resilient

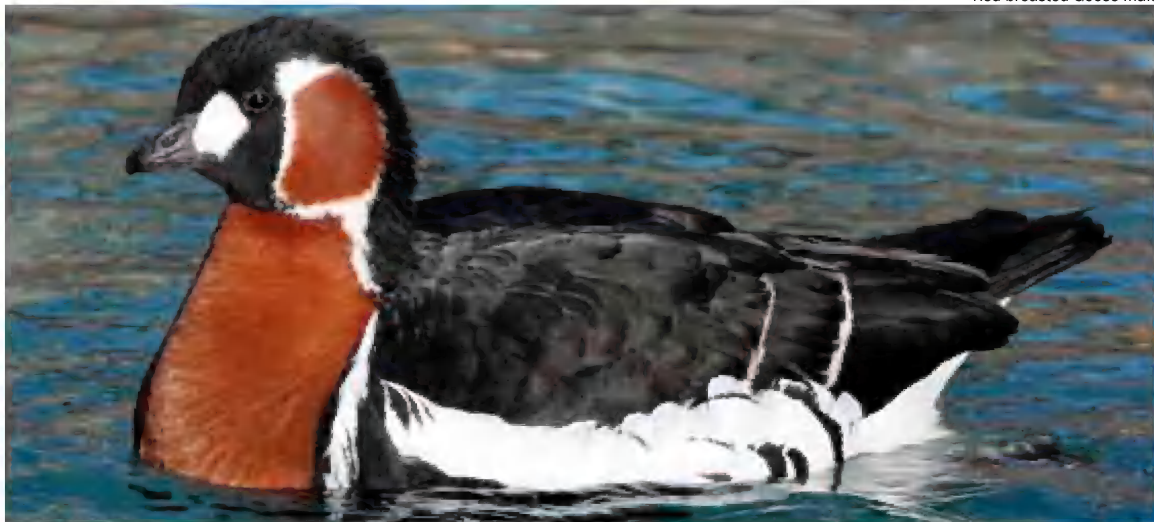
While some species of waterfowl decline, others have taken to man's modified habitats with ease. Canada Geese (*Branta canadensis*) have become a familiar resident (and occasional pest) in the suburban and urban areas of North America as well as the United Kingdom and mainland Europe. Snow Geese (*Anser caerulescens*) and Ross' Geese (*Anser rossii*) populations continue to grow in numbers in North America despite control efforts. Mute Swans (*Cynus olor*) can be found living alongside humans in northern Europe and more recently in eastern North America where they have been introduced. Despite their successes, none of these species can compete with the versatility of the Mallard. This remarkably adaptable duck has invaded eastern North America, the Hawaiian Islands, southern Africa and Australasia, while in domesticated and feral forms it can be found just about anywhere humans live.

Mysterious

The seasonal appearance and inevitable disappearance of migratory waterfowl leave us wanting to know more. Where do they go? Which route do they take? How long does it take them? With the use of banding, auxiliary markers (like neck collars), radio transmitters and satellite tracking, scientists have made major inroads to answering these very questions.

- ▶ Pacific Brant (*Branta bernicla nigricans*) make a 60 to 95 hour migration from the Alaskan peninsula, across the Pacific Ocean to wintering grounds on the Pacific coast of Canada, North America and Mexico. Their flight can be as far as 3,000 miles!
- ▶ The wintering grounds of the world's population of Spectacled Eiders were only discovered in the mid-1990s. These cold-hardy birds winter in polynyas, pockets of open water in the otherwise frozen Bering Sea.
- ▶ Noted conservationist and Sand County Almanac author Aldo Leopold wrote:
"One swallow does not make a summer, but one skein of geese, cleaving the murk of a March thaw is the spring."

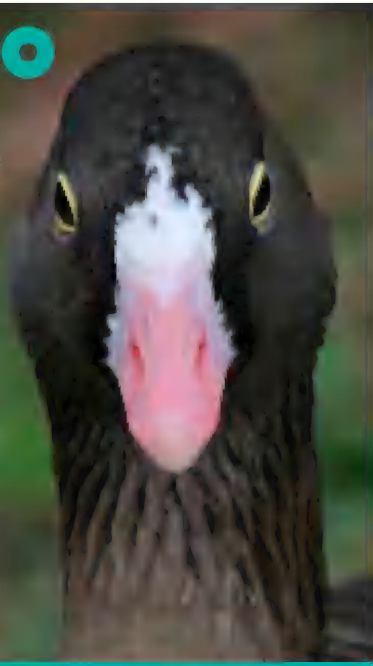
Red-breasted Goose male



Culturally significant

Waterfowl are important players in religion, literature, animal domestication, animal behavior, aviculture and even popular culture.

- ▶ The Mallard, Muscovy (*Cairina moschata*), Graylag (*Anser anser*) and the Swan Goose (*Anser cygnoides*) have all been domesticated and provide humans around the world with meat, eggs and feathers. Mute Swans and Egyptian Geese (*Alopochen aegyptiacus*) have been partially domesticated with feral birds found in North America and Europe.
- ▶ Over 90% of the waterfowl species have been kept and bred in captivity. Almost every zoo in the world maintains some sort of waterfowl exhibit or keeps ducks or geese in a display. Private aviculturists frequently keep waterfowl too, with the practice being particularly prevalent in North America and Europe. The eye-catching colors and activity of waterfowl allow them to play an important role in educating the general public about the need to conserve wetlands and their wild relatives.
- ▶ Nobel Prize winner Konrad Lorenz studied Graylag Geese and learned much about animal behavior, including the process of imprinting. Imprinting is a rapid learning process by which a newborn or very young animal establishes a behavior pattern of recognition and attraction towards other animals of its own kind, as well as to specific individuals of its species, such as its parents, or to a substitute for these. Goslings, for example, will imprint upon and follow the first large moving object they observe. In nature, these are usually their parents, but they can be made to imprint upon other moving objects, including humans.
- ▶ Charles Darwin was fascinated by the unusual shape and stance of the domestic runner duck and was inspired to document the inheritance of characteristics, such as plumage color or body shape, influenced during the domestication process.
- ▶ Waterfowl, primarily geese and swans, were important figures in Greek and Roman mythology. They also play roles in Indian, Native American, Aboriginal, Buddhist, Anglo-Saxon and Norse legends.
- ▶ Waterfowl appear in many phrases of the English language. "Like water off a ducks back", "lame duck", "wild goose chase", "what's good for the goose is good for the gander", "like a duck to water", "swansong", "goose-bumps", "goose-step", and "to kill the goose that lays the golden egg" are among the most popular.
- ▶ Children's books like *Make Way for Ducklings*, *The Ugly Duckling*, *Ping*, *Mother Goose* and *The Trumpet of the Swan* are timeless favorites. Babies bathe with rubber ducks, pre-schoolers play "Duck, Duck, Goose" and older kids play "Duck Hunt" on their game consoles.
- ▶ Waterfowl, especially ducks, are famous film, comic and cartoon characters. Disney's Donald and Daisy Duck, along with their Warner Brother's counterpart Daffy Duck are still popular children's characters. "Darkwing Duck" and "Duck Tales" television cartoon shows entertained children of my generation when they arrived home from school. Gary Larson's *The Far Side* comics often contained ducks.
- ▶ Commercial products with waterfowl namesakes like "Duck Tape" and the "Toilet Duck" are found in many of our homes. A domestic pekin duck helps the Aflac Insurance Company sell their product too.
- ▶ The Anaheim, California professional hockey team and the sports teams of the University of Oregon use ducks as their mascots.



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Visible

Waterfowl are big and easily noticeable. They are visible on the landscape and are large enough to be considered a meal. Harvest for food and sport, both regulated and unregulated, occurs wherever waterfowl and humans meet.

Economically valuable

Hunting waterfowl is big business. It is especially popular in the Americas, Europe, Australia and New Zealand. In the United States alone in 2011, there were approximately 2.6 million migratory bird hunters who spent \$6.5 billion dollars on hunting-related travel, equipment and other items. Through the Pittman-Robertson act, waterfowl hunters contribute over \$7.5 million dollars a year to waterfowl research and habitat conservation.

Whole industries have been built around waterfowl hunting: "duck guns", decoys, clothing, ammunition, duck calls, boats and even dogs! The well-known Labrador retriever and poodle were selected for their ability to retrieve downed waterfowl, and many continue to do so to this day. Waterfowl watchers also spend a lot of money. In 2011, American wildlife watchers specifically focusing on waterfowl totaled an estimated 13.3 million people. Travel, binoculars and other equipment costs for these waterfowl enthusiasts were approximately \$550 million dollars. 🦆

Photos by Ian Gereg.

Editor's Note: An original version of this article was initially published on the Livingston Ripley Waterfowl Conservancy's website at <http://www.lrwc.net/whywaterfowl.html> in 2012.

Waterfowl Conservation: The next generation

Joanna Klass, Zoo Keeper, Woodland Park Zoo
Formerly Bird Keeper III, Caldwell Zoo

It was late February 2016, and a dozen people huddled behind bare tree limbs at the edge of a placid lake in Scotland Neck, North Carolina. The sun had begun to sink, and with it went the temperature. A single tundra swan circled overhead. Shoulders sank disappointedly as we watched it wheel off in the other direction. The following minutes of silence left us wondering if the large white birds had chosen another lake for the night. Our spirits were soon lifted when the whistles and honks of thousands of swans broke over the lake and they began their descent, shattering the water's surface as they splashed in feet first. We were quiet witnesses to a natural part of winter in North Carolina, and it was a perfect reminder of the reason we all do what we do.

Sylvan Heights Bird Park in Scotland Neck, North Carolina along with the International Wild Waterfowl Association (IWWA) hosted the first Future of Waterfowl Conservation Workshop (FWCW) from February 26-28, 2016. Over 70 individuals from around the world gathered to discuss all things waterfowl, including husbandry, common veterinary issues, and impactful methods for educating the public. The group was comprised of professionals from both private and public facilities, creating a well-rounded workshop with multiple perspectives.

The main goal behind this workshop was to forge a diverse network of aviculturists and encourage communication within the younger generation. The current state of waterfowl populations in both public and private North American facilities has shown a gradual decline over the years, with few facilities offering substantial breeding programs. Major causes for this include competition for exhibit space in zoos and a

reduction in the popularity of aviculture among young people. The FWCW sparked discussion about overcoming these obstacles and promoted dialogue regarding realistic next steps to take as a group.

Each day focused on a different topic pertaining to the preservation and husbandry of waterfowl. The workshop centered around four major focal points: captive propagation, veterinary care, education, and conservation. Exciting research projects focusing on captive reproduction efforts for the Brazilian Merganser and Steller's Eider, foraging studies on sea ducks using dive tanks, and hearing tests for ducks to mitigate damage by human activity were shared. Awareness was brought to rare species in need, such as the Baer's Pochard and Scaly-sided Merganser, and educators shared successful techniques for incorporating waterfowl in powerful messages for the public.

The large turnout for the workshop is perfect kindling to continue the discussion on how to improve best practices in waterfowl husbandry and research. The second Future of Waterfowl Conservation Workshop will be held in winter 2019 with the precise date yet to be determined.

I would like to express my gratitude to all that made attending this event possible, including the American Association of Zoo Keepers (AAZK) for awarding me a Professional Development Grant, those who wrote letters of recommendation supporting my application, and Sylvan Heights and the International Wild Waterfowl Association for putting on an incredible workshop.



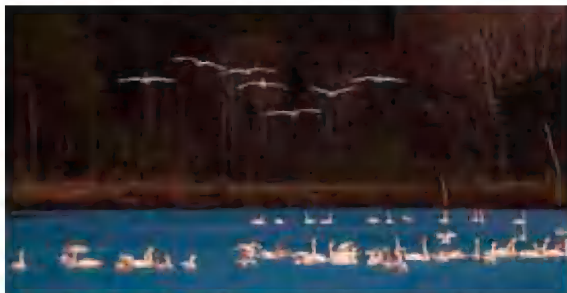
Workshop attendees outside of the main visitor lodge at Sylvan Heights Bird Park. Photo by Jan Harteman 2016.



Mike Lubbock, Executive Director and Founder of Sylvan Heights Bird Park, signing books for workshop attendees Melanie Kuilder and Denzel De Mello. Photo by Jan Harteman 2016.



Professional Development Grant Recipient Joanna Klass interacting with an American Flamingo (*Phoenicopterus ruber*) at the Sylvan Heights Bird Park walkthrough aviary. Photo by Katie Gipple Lubbock 2016.



Overwintering tundra swans (*Cygnus columbianus*) arriving for the evening at a nearby lake. A large population of these birds congregates in North Carolina during the winter months. Photo by Katie Gipple Lubbock 2016.



Brad Hazelton, Director of Animal Collections and Grounds at Sylvan Heights Bird Park, gives a tour of the facilities to a group of program attendees. Photo by Katie Gipple Lubbock 2016.



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Trumpeter Swan. Photo by Dale McDonald

Trumpeting Waterfowl Conservation: Protecting the keepers of nature's waterways

Tiffany Mayo, Lead Hospital/Commissary Keeper
Cleveland Metroparks Zoo
Cleveland, Ohio

Introduction

Conservation. By definition, it is the careful preservation and protection of something. It has been the buzzword in our industry lately. But why now? Conservation in zoos is nothing new. Participation in various programs has been ongoing for decades. Only recently has it come to light how important it is to get the message out to visitors about our efforts and the collective impact zoos and aquariums have on protecting wildlife. This core theme generates many questions. What programs should your institution support? Where will conservation dollars have the most influence? What will resonate most with visitors? The

answers will vary from institution to institution based on various factors such as size, collection, resources and Association of Zoos and Aquariums (AZA) Saving Animals from Extinction (SAFE) programs.

According to Dan Ashe, President and CEO of AZA and former Director of the United States Fish and Wildlife Service (USFWS), "beyond an unquestionable reputation for animal care, commitment to conservation of animals in nature and demonstrated success in saving animals from extinction will be the factors elevating the merely good to the truly

great within the zoological community, and ensuring prosperity of and among 21st century aquariums and zoos."

Waterfowl conservation is also nothing new. Its necessity has been apparent since the early part of the 20th century. Due to habitat loss and previous unrestricted market hunting, many populations of waterfowl have been negatively affected and some nearly decimated. Government agencies and well-known conservation entities such as Ducks Unlimited have been heavily involved in waterfowl conservation.

The USFWS recognized the importance of waterfowl and wetlands to North Americans and the need for international cooperation to help the recovery of shared resources. In response, the U.S. and Canadian governments developed a strategy to restore waterfowl populations through habitat protection, restoration, and enhancement. This strategy was documented as the North American Waterfowl Management Plan signed by the U.S. and Canada in 1986. Its vision of collaborative conservation is still relevant today (North American Waterfowl Management Plan, 2016).

Once you find that connection with people, it inspires them to take conservation action.

Ducks Unlimited is the world's largest private, nonprofit waterfowl and wetlands conservation organization. Their mission is to conserve, restore, and manage wetlands and associated habitats for North America's waterfowl, which also benefit other wildlife and people. Their vision is to have wetlands sufficient to fill the skies with waterfowl today, tomorrow and forever. Since 1937, Ducks Unlimited has conserved more than 14 million acres of waterfowl habitat across North America and supporters have raised nearly 3.5 billion dollars for conservation (Ducks Unlimited, 2017).

Zoos and aquariums also support waterfowl conservation. Their participation in 14 waterfowl Species Survival Plans (SSP) has made programs such as trumpeter swan restoration successful by bolstering a population that was nearly wiped out. There are many reasons why waterfowl conservation is important and significantly benefits your organization and staff when taking part in initiatives.

Connecting People to Their Environment with Waterfowl

First, waterfowl are a flagship indicator of healthy habitats and wetlands. As the SSP Coordinator and Studbook Keeper for trumpeter swans, I was lucky enough to participate in a trumpeter swan release in southern Iowa this past May. I was able to hear Dave Hoffman from the Iowa Department of Natural Resources (DNR) speak to the public and school groups about the swans before they were released. When he asked the collective group why they wanted to see swans in Iowa he received several different answers, but I will never forget his response back to the crowd. He said that the swans are symbols. They are symbols of healthy wetlands and clean water.

He also explained that healthy wetlands are important because they are nature's water filters. It was such a simple statement, but in my eyes, an extremely powerful one. It connected people not only to swans, but to their personal environment and the bigger picture. Conserving swans and their habitat also provides a cleaner environment for themselves, their children and grandchildren; making them proud of the place they call home. I have used this analogy since then many times to explain the importance of trumpeter swan conservation. Once you find that connection with people, it inspires them to take conservation action.

The Local Aspect of Waterfowl Conservation

Waterfowl conservation has a substantial local component. Many programs are based in North America and encompass an abundant number of species when it pertains to habitat restoration. Local species like the American wood duck and common merganser can act as ambassadors for their international counterparts by linking people to other waterfowl in peril around the world such as the white-winged wood duck and scaly-sided merganser.

Waterfowl housed in zoos take minimal resources and are easily raised and maintained. Zoos that exhibit waterfowl have the ability to tell the story of their challenges and comebacks along with the crucial role that zoos play in their conservation. The American wood duck is a good example of a local conservation success where zoos can easily exhibit a species while relating a positive message about reversing human impact on a bird that neared extinction in the early 1900's.

The trumpeter swan is another species that is on the rebound thanks to restoration programs across the country. With the help of zoos in collaboration with government agencies and groups like The Trumpeter Swan Society, the population of trumpeter swans has reached sustainable numbers. Due to strong involvement since the 1980's, zoos have contributed not only funding, but have hatched and raised trumpeter swan cygnets for release into the wild. Cleveland Metroparks Zoo, in conjunction with the Ohio DNR and The Wilds, was an integral part of an initiative that collected a total of 150 trumpeter swan eggs from Alaska in the late 1990's and released them into Ohio (Hathaway, 2006). Due to these efforts, there is now a stable population of around 300 swans in Ohio (Trumpeter Swan, 2012).

Currently, zoos are still actively participating in trumpeter swan restoration by providing cygnets and eggs to various programs across the country. As they are a North American species and waterfowl in general are easy to



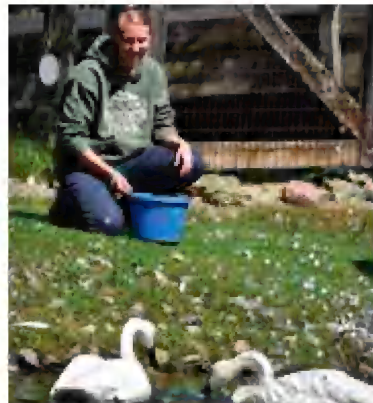
The trumpeter swan exhibit at Columbus Zoo and Aquarium with a graphic depicting their natural history and zoo conservation initiatives.



Iowa DNR Wildlife Research Technician, Dave Hoffman, teaching a school group about trumpeter swans and conservation before they were released into southern Iowa in May 2017.

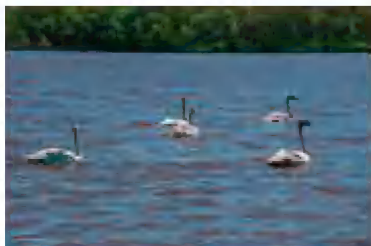


Ready for release! Trumpeter swan cygnets getting ready to be released into Southern Iowa. Zoos have been heavily involved in trumpeter swan conservation for several decades.



Megan Walsh, an Animal Keeper from the Northeastern Wisconsin (NEW) Zoo and Adventure Park, taking care of their pair of trumpeter swans on exhibit. Despite only having nine full-time keepers, the NEW Zoo has actively participated in trumpeter swan restoration initiatives for many years. Photo by NEW Zoo and Adventure Park

Staff from five different zoos coming together and getting the opportunity to be directly involved in Iowa DNR's trumpeter swan restoration program. Zoos contributed a total of 14 cygnets to the program in 2016-17. Photos by Holly Welch.



transport, relocating the swans to release sites is usually very cost-effective. Even though the restoration of the trumpeter swan is considered a success, they still only inhabit about 1/3 of their historic range and are susceptible to obstacles such as lead poisoning, power line collisions, continued habitat loss and climate change. The story of the trumpeter swan can easily be related to other waterfowl as they often face the same issues in the wild.

Since many programs are local or regional, it is also logistically easier for staff to get directly involved in waterfowl habitat restoration and reintroduction programs. This year alone, five zoos came together in Iowa to release trumpeter swans raised at their zoos or contributed fertile eggs to the program. Due to the close proximity of the release, most of the zoos participating were able to drive

to the release site and send multiple staff members. This type of participation, especially for smaller facilities, cannot always happen with international conservation due to limited budgets and resources. An experience like this gives staff a firsthand connection with conservation as well as the opportunity to practice what they preach.

Incorporating AAZK into Waterfowl Conservation

Finally, being involved with the American Association of Zoo Keepers (AAZK) is yet another outlet to advocate for waterfowl conservation. Regardless of the size of your AAZK Chapter, supporting waterfowl initiatives is a great way to get your community involved in conservation. For example, the Greater Cleveland Chapter of AAZK held a Wine and Canvas painting fundraiser at a local brewery to raise funds for The Trumpeter Swan Society in February 2017. It was found that many of the attendees including the artist herself had no idea trumpeter swans were native to the area or knew anything about their history. Not only did the Chapter raise money, but they were able to bring awareness to an iconic species.

Conclusion

Zoos are tasked with the enormous challenge of prioritizing conservation endeavors. Waterfowl conservation has benefited from the support of many organizations primarily through land preservation and restoration programs. Waterfowl are the perfect segue into teaching the significance of protecting fragile ecosystems that people and animals need. Dave Hoffman from the Iowa DNR summed up Iowa's successful conservation strategy as being able to engage, connect and empower the public into protecting and restoring wildlife and their habitat. This strategy also applies to keepers as we are on the front lines as the

experts to visitors who want to learn about animals in our care and how they can help them in the wild.

Being part of the Trumpeter Swan SSP has been one of the most fulfilling aspects of my 15 year career as a keeper. It has been extremely rewarding to help zoos come together in collaboration to not only house a genetically sustainable population under human care, but to assist in the restoration of the wild population. One of highlights of this position has been sharing the conservation work of zoos and getting visitors and staff alike excited and invested in a species that acts as a representative for wetlands and all waterfowl. This association can help people forge the way into conservation action.

Whether it is manpower needed to restore critical habitat, participating in reintroduction programs and SSP's, or hosting a fundraiser to support an established organization, your facility or Chapter can make a large impact on waterfowl conservation and preserving the lands vital for their survival.

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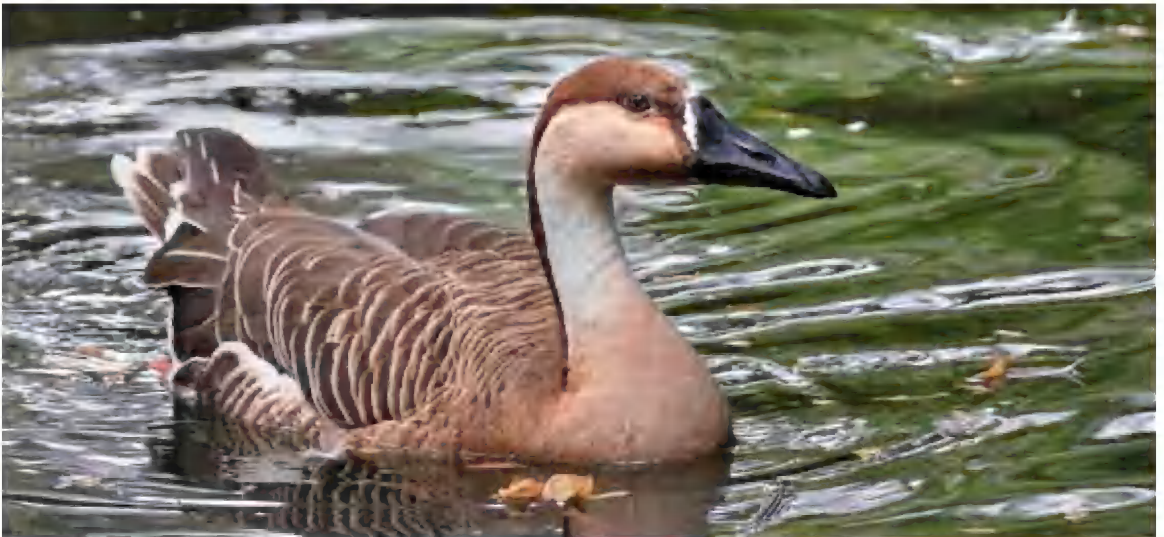
Photos taken by author unless otherwise noted.



A wine and canvas fundraiser hosted by Greater Cleveland Chapter AAZK, which benefited The Trumpeter Swan Society and raised awareness about local waterfowl and conservation. Photo by Mike Negron.



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African Pygmy Geese (*Nettapus auritus*) at SeaWorld San Diego

William Robles
Zoo Supervisor
Turtle Back Zoo

The African Pygmy goose (*Nettapus auritus*) is one of the smallest species of ducks in the world. Despite its name and its small bill (which closely resembles that of other geese) this is indeed a duck. The species is arboreal, perching in trees and nesting in tree cavities. Its bill is used similar to dabbling ducks, by filter feeding along the surface of the water. It is a strict vegetarian, primarily feeding on water lilies and seeds. APG can be found across sub-Saharan Africa and into southern Africa. Yet throughout that range, they are very habitat specific, preferring deep clear waters with abundant aquatic vegetation.

African Pygmy Geese are often left full-winged due to their natural cavity nesting behavior, which allows them to not only live among a variety of species, but nest above ground as they would naturally. When given the opportunity to perch above the water they will do so willingly, giving visitors a close-up view of waterfowl.

Mature, bonded birds often stick quite close to one another all year long, with the female almost always vocalizing towards her mate. This tight bond could be the reason these

birds can have success breeding in ponds with multiple waterfowl species around them. Being an African species, they usually make their appearance in African aviaries, but can also be mixed in International exhibits.

SeaWorld San Diego has had success breeding two separate pairs in two very different, off-exhibit mixed breeding aviaries. The first exhibit contained Chestnut-breasted Malkohas, Roseate Spoonbills, Siberian Red-breasted geese and multiple other waterfowl species. This exhibit has a large salt water pond with a fresh water drinker that overflows into the larger pond. The second aviary houses Malay Argus Pheasants, Black-naped fruit doves, and other soft-bills. In contrast, this exhibit has a small fresh water pool with constant water flow. Water quality should always be a priority when housing delicate waterfowl species. They have nested in both a short porch box at the water's edge and a drilled-out palm-log, four feet above the water's surface. It should be noted that if these birds are housed in a small pond, for breeding to be successful they should be the only waterfowl species inhabiting this pond.

While both of these exhibits are "busy" in terms

of the number of species being housed, the fact that the Pygmy Geese are left full-winged is a huge benefit to the pairs. If spooked these birds can easily choose another area within the exhibit to safely perch. An exhibit sized large enough to allow the birds some solitude is optimal for breeding. Providing these birds with visual barriers seems to keep them much calmer, giving them a sense of protection when going into their breeding season. In large ponds, planters with purple fountain grass have been installed to give them plenty of areas to feel comfortable. When working with smaller ponds, plants can be lined around the pond's perimeter to give it a "cove" feeling.

In San Diego with temperatures moderate most of the year, these ducks usually wait until mid to late summer to breed. While they do well outside all year in Southern California, their breeding behavior appears to escalate when the temperature is 80F daily. No heat source is provided as they can handle temperatures down to 55F without issue. If needed, they can be moved to an indoor "tropical" aviary during winter, and moved back outside in the summer for breeding. 🦆



Palm log interior



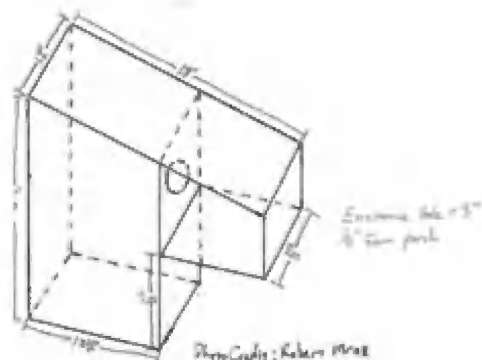
Palm log box



Secluded Pond

Palm Log Dimensions

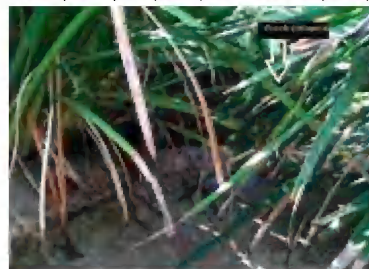
24"-36"
 .5"-11" Diameter
 Hollow out 1.5'-2' deep
 Entrance hole 3"-3.5" Diameter
 Entrance hole 4" from the top
 of the box
 Removable lid
 Cork bark added to the front for
 easier access
 Small wire ladder added to
 inside for easier exit



Palm log above water's surface



Mixed-species pond (above) Porch Entrance (below)



Modifying an Existing Space for Rearing Waterfowl

Mindy Rabideau, Primary Aviculturist
Tracy Aviary
Salt Lake City, Utah

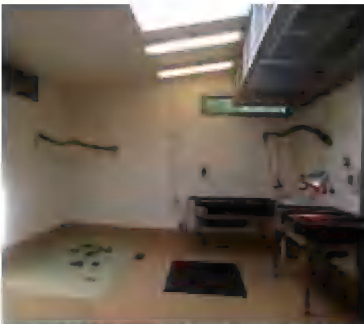


Photo 1. The N half on the rearing set up with wet brooders along the wall and the pond with older ducklings. This photo was taken before the brackets were added to assist in hanging heat lamps as mentioned later in the article.



Photo 2. Wet brooder set up with minimal water coming through the insert for new chicks. The bricks are used to make sure the insert is flush and chicks can't get under it. The screen cover is off for this and the next two photos for better visibility.

Tracy Aviary drastically increased its waterfowl collection in the winter of 2008. We started with roughly 60 birds and added about 100 individuals in order to place waterfowl on two of our large ponds that previously had little to no waterfowl. Starting in 2010 we began rearing waterfowl to fulfill requests by other institutions. To accomplish this, we repurposed a holding space attached to our wetlands exhibit that was generally only used in the winter months. The holding space in question is an approximately 15' by 20' room intended to house our wetlands birds when they need to be off exhibit (see photo 1). This room features soft flooring, a built in pond, and a skylight.

Initially, chicks were reared in wooden dry brooders that were already on hand from rearing other species. Chicks were kept in the dry brooders until they were big enough to be placed in a "transitional space." This transitional space was made of PVC and used to turn a corner of the room into a separate space with a large tray of water. Once the chicks were doing well with the water and big enough, they would be moved into the main portion of the room with access to the larger pond. Since then we've moved to rearing birds in wet brooders. Wet brooders were made in house from purchased pond liners from the hardware store that had a built in shallow area. The shallow area acts as the land space and the deep area acts as the pond. To modify the pond liners to have the main features of a wet brooder, our maintenance staff installed a drain in the bottom of each liner, made stands to hold the pond liners up to a comfortable height for the keepers to work with, made inserts to cover the pond area, and made a screen cover for them.

The addition of the wet brooders allowed us to get rid of the transitional space. When using

the wet brooders, newly hatched chicks would be moved over to the rearing room once dry and placed into a wet brooder with the cover over the pond so just a tiny bit of water was coming through the mesh (photo 2). The amount of water coming through the insert over the pond was increased each day (photo 3). Depending on species and how the chicks were developing, access to the whole pond was given after a few days (photo 4). Chicks are watched closely when first given access to the whole pond to make sure they are easily able to get out of the water and don't get too wet. Once the chicks are big enough (we generally use 100 g as the criteria size), we move them into the main room with the big pond.

After switching to wet brooders, we needed a new solution for what to do with the chicks while the brooders were being cleaned. We accomplished this by having our maintenance staff construct a small dry brooder. This dry brooder is approximately 3' square with deep sides, caging bottom, and on legs with wheels to make it high enough for the keepers to use comfortably and easily moveable around the room. Since the chicks need to be moved out of the wet brooder daily for it to be cleaned, they are weighed when being placed in the dry brooder each day. We use daily weights to make sure the chicks are eating well and growing appropriately. For birds that need to be pinioned, we look for the chick to be gaining weight at a good pace before we pinion. Once the birds move into the main room, they are weighed the day after to make sure they adjusted to the move well. If their weight is good the next day, we weigh again in a few days. Once the chicks are adjusted to the main room, they are weighed once a week until their growth slows (around the time they grow feathers) and then they are weighed every other week. Whenever a chick is in hand to be weighed, we check that the band



Photo 3. Wet brooder set up with most of the insert submerged under water. This is typically how the wet brooder looks the day before the insert is removed.



Photo 4. Wet brooder set up with access to the full pond.

isn't tight (we use colored cable ties to tell the chicks apart). We also routinely check the feet to make sure they're not developing bumbles and keep an eye on blood feathers when feathers are being grown in.

The room used for rearing has a UV-penetrable skylight. However, we began seeing angel wing in a few of our ducklings and wanted to come up with a way for the birds to get more sunlight. There is a set of double-doors on this room that lead to the exterior of the building. We had an extra caging panel with a door in it from a previous project, so that was secured over the doorway from the inside (photo 5). Now the double doors stay open as long as the weather is good to allow more sunlight into the room. The chicks still small enough to be in the wet brooders are moved into the sunlight during their time in the dry brooder while their wet brooder is being cleaned. Chicks with access to the entire room have free access to sunlight. We haven't seen any angel wings since using this modification. The doors face into a garden bed and keeper access space, so there is no guest viewing of the ducklings, but the ducklings are exposed to all the sounds of the aviary.

Many of our duck species have been successfully reared using this setup, but we were still having some issues with harder to rear species. As we talked to other people and

saw other setups, we realized that the main thing our setup lacked was moving water in the wet brooders. We set up a drip line over each brooder to allow an adjustable flow of water to drip into the floating food dish to encourage interest in food. We also purchased underwater aquarium pumps to make the pond water move to encourage more interest in it and the food floating on it.

Other modifications to the room include shelves near the wet brooder that fold down so they can be out of the way when they're not needed and brackets above the land space of the wet brooders to allow for heat lamps to be installed in an easier way.

Since this room is dual purpose, everything in it needs to be able to be easily moved out of the way or safe for all the birds that use the room throughout the year. The room is deep cleaned and set up for ducklings each spring. We try to give ourselves adequate time to set up and we have a goal of having it complete by the time the first eggs are being incubated. Having it done early allows for the heat lamps and drip system to be adjusted over several days to make sure everything is just right and we're not rushing to get things together as chicks are hatching. After duckling season, all the duckling supplies are moved out and stored until they are needed last year. The shelves, brackets, and caging over the exterior door stay in the room and require some modifications. The shelves are folded flush to the wall, the brackets are wrapped in padding, and the caging is covered. Some of our wetland birds have very thin, delicate beaks and legs, so every potential catch for them is addressed before the birds are given access to this room in the colder months.

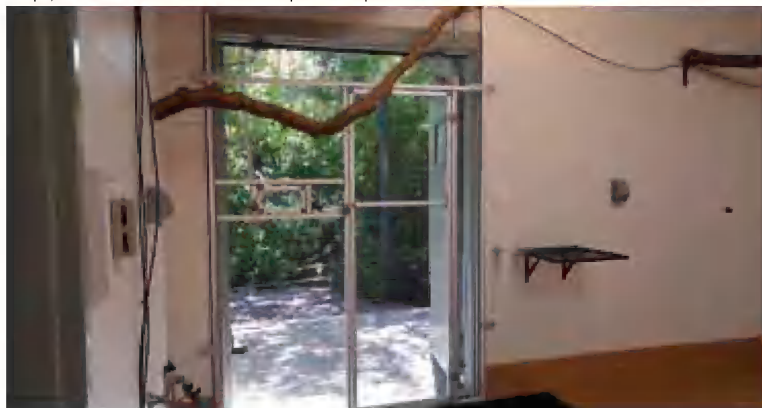
Another thing we have used this room for is parent rearing chicks. If a duck nests in a box

that is moveable, we are able to move the hen, clutch, and nest box into the room. This only works with some of our hens. Others are too freaked out about the move and change of surroundings to continue sitting and will abandon their box usually within a day or two of the move. For example, one of our ruddy hens will continue to incubate, but two of the others we have tried abandoned. If the hen abandons, we move the eggs to an incubator so the chicks can be hand-reared. However, with the hens it does work with (we keep track of who will and won't continue sitting when we try), the hen is able to do all the incubating and rear her own ducklings. Once the hen is incubating in the room, we do not check on her. We instead watch for food consumption and feces to make sure she is doing well. The hen then stays in the room until her ducklings are feathered before she returns back to exhibit. We have not had issues introducing hand-reared chicks into the main room when there is already a hen and her clutch in there, but the introductions are always closely monitored.

Using an existing space and making modifications in-house has been successful for us. Although the number and species of chicks are dependent on what is requested each year, we have successfully reared fourteen species with our set up. It is not a perfect room, but it functions well and small changes are made year to year to adjust various items to perform better in the upcoming breeding seasons. All the changes that have been made since we first started using that space for rearing chicks have been relatively easy and have led to better care for the chicks and ease of use for the keeper staff. Going forward, we hope to get in some SSP species and use our rearing room and skills to contribute to their populations.

All photos by Mindy Rabideau.

Photo 5. Caging insert over doors to let sunlight into room. This photo also shows newer additions to the room such as the black lines that carry the water for the drip system, the brackets used to hang heat lamps, and the shelves installed as keeper work space that can be folded down when not in use.





A Steep Learning Curve: Artificial incubation of white-faced whistling ducks with limited resources

Jennifer Fair, Zoo Keeper
Greenville Zoo
Greenville, SC



Photo 1. Newly hatched duckling being examined by vet staff



Photo 2. Newly hatched ducklings from first clutch

Introduction

Historically there has been little to no avian artificial incubation undertaken at the Greenville Zoo. However, in January 2016 a Hatchrite Incubator for ostrich and emu eggs became available when another facility decided they had no need for it. The Greenville Zoo decided to take the incubator. Unfortunately, due to limited space at the zoo, the only space available to set up the incubator was in our anteatery barn. I decided that a good starting point would be to incubate white-faced whistling duck (*Dendrocygna viduata*) eggs, as I had learned from colleagues that they are a less demanding bird egg to artificially incubate. Our lagoon exhibit, which houses our 4.1 Chilean flamingos (*Phoenicopterus chilensis*), 0.2 black swans (*Cygnus atratus*), 2.2 hooded mergansers (*Lophodytes cucullatus*), and 4.4 white-faced whistling ducks, is an open exhibit with undeveloped, wooded land behind the exhibit that extends to our perimeter fence. Due to the exhibit being open and the natural, low traffic habitat behind the exhibit, we experience predation issues on our birds in the exhibit. We also have a healthy population of Eastern black rat snakes (*Pantherophis obsoletus*) at the zoo and they make it impossible for our ducks to incubate eggs naturally as our ducks begin laying at the same time the snakes come out of brumation and are looking for an easy meal of duck eggs. A few years ago we were able to successfully relocate a pair of white-faced whistling ducks and their nest to another exhibit which was enclosed by Plexiglas, keeping it safe from snakes. Unfortunately that exhibit was removed during recent renovations so moving a nest is no longer an option. This led to my desire to try artificial incubation with these ducks. The initial problem is that the snakes find and eat the eggs well before the ducks are able to incubate them, and secondly, ducklings have a tough time surviving in the environment due to their being such an easy target for a variety of predators that could visit, such as raccoons, opossums, owls, hawks, and fox.

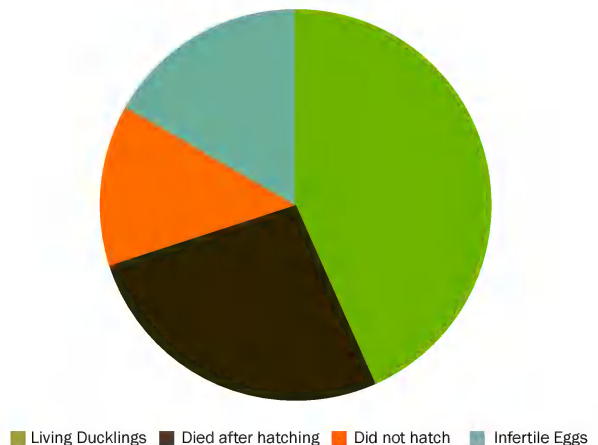
Methods

Since the zoo's population of black rat snakes prefer to go for the easiest meals, I have to pull duck eggs as soon as I find them. Initially I was just picking up the eggs as I found them, which could be a challenge because if the ducks weren't on the nest it was very difficult finding a well concealed nest site. I quickly learned that by removing eggs from the nests the ducks would move their nest sites. I decided a good strategy would be to replace any duck eggs that I removed with unfertilized chicken eggs. By doing this, the ducks still had eggs to sit on and it would not be a problem when the snakes ate the chicken eggs as opposed to eating dummy eggs in the nests which would obviously cause major issues for the native snakes. If the eggs were not removed when found they would be gone, sometimes within the hour. Since I was only finding one egg at a time I decided that I would wait until I had at

least six eggs before starting to incubate. I knew I could store the eggs for up to 10 days at a temperature of between 55-65 degrees before starting incubation with no negative effects on future egg development.

I ended up incubating 30 eggs in three different clutches. I created a log sheet for each egg and as eggs were collected the log was filled out for each one giving the egg a number and recording parents if they were known. One pair (Pair A) of ducks produced the majority of the eggs that were collected for incubation. The other pairs (Pair B, C and D) may have produced a similar number of eggs but did a much better job of keeping their nests secretive so that staff were unable to find the eggs before the snakes did. Another pair of ducks (Pair B) was identified as the parents of six of the eggs, but for the final nest found, the duck pair was not determined.

I collected the first egg on April 4, 2017. Three more eggs were collected from that nest on April 8th. After removing these three eggs Pair A decided to abandon the nest, however when a chicken egg was placed in the nest the ducks became curious, and later that day the female had returned to the nest. On April 9th and April 10th, eggs 4 and 5 were removed from the first nest, as well as another two eggs from an additional nest site. Pair A moved to a new nest site and on April 12th two eggs were pulled and chicken eggs were placed in the nest as substitutes. The female



was observed laying in the nest later that same day. A new nest was found and a single egg pulled on April 14th. Two more eggs were pulled from Pair A's nest on April 19th, and another on April 20th. On April 22nd two more eggs were pulled, and another egg was collected from the same nest on the following day. A new nest containing nine eggs was found on April 28th; all eggs were collected. The final egg was collected for incubation on May 2nd.

As the eggs were collected they were wiped off with a dry towel. Before the eggs could begin incubation the incubator's rollers had to be moved closer together to hold the small eggs. This was easily achieved. The incubator was then tested with chicken eggs to ensure rollers were rotating the eggs 180° as needed. The incubator was started up and running for a couple of days prior to the eggs being placed inside. This was to ensure the temperature was being held at the desired 99° as well as the correct humidity was being reached. Initially we had trouble getting the humidity to the 55% that was needed, so extra trays of water were added to the bottom of the incubator. When that was not enough, a five gallon bucket with a small aquarium heater and air pump were connected to the incubator to create an external humidity chamber. The external chamber was connected to the incubator via clear plastic tubing running from a hole cut into the bucket's lid to the incubator's humidity chamber. Unfortunately, not long after the first duck eggs were placed in the incubator, the rollers began to malfunction and were not turning the eggs the needed 180°. This meant that we had to hand-turn the eggs. This was far from ideal as it meant opening the incubator multiple times every day, allowing the humidity to escape the incubator. To compensate for lost humidity additional water trays were added to the bottom of the incubator. Due to limited staffing it was decided to hand-turn the eggs three times a day, once initially in the morning (approximately 0830 hrs), then again at 1200 hrs, and finally at the end of the day (approximately 1630 hrs).

The incubation period for white-faced whistling duck eggs is 26-28 days. The eggs were pulled from the incubator at day 24 and placed in a modified Reptibator. To get the desired 70-80% humidity for hatching, a humidifier was hooked up to the Reptibator. A tube ran from the output of the humidifier to the Reptibator. Once eggs were placed into the Reptibator they were no longer being turned, just closely monitored for signs of hatching.

After hatching, the ducklings were moved to brooders, which were tubs of varying sizes depending on how much space the ducklings needed and what was available. Heat lamps were used to give the ducklings a

heat source and each brooder had a UV light set up to a timer to give the ducklings much needed Vitamin D and hormone regulation. The heat lamps, initially hung so the warmest part of the brooder was 99°, and were gradually raised slightly higher each week until the ducklings were able to handle the 80° that the barn is kept at.

Incubation Results

The first clutch set up for incubation (Clutch 1) were the first eight eggs collected, six of which were from one duck pair (pair A) and the other two from a different duck pair (pair B). Of this clutch, two eggs were confirmed infertile via candling, two more were suspected of being infertile and when necropsied they were found to have mold spores within, suggestive of *Aspergillus*. Four of the eight eggs hatched; sexing revealed 3.1 ducklings. One duckling, ("Glitter") was found deceased on day 3 after hatch date. Another duckling ("Blue") died at 56 days of age.

The second clutch set for incubation were the next 12 eggs collected (Clutch 2). All but one egg were laid by the same pair of ducks (pair A). Of these 12 eggs, only one was infertile, another one was developmentally arrested. Ten eggs hatched yet six ducklings died, leaving 1.3 ducklings. The first, ("Black"), was found deceased on day 2, another duckling, ("Maroon"), was found deceased on day 4 and another duckling ("Pale Purple") had to be euthanized at 4 days of age. The next duckling ("Pink") died at 5 days of age, then the next, ("Orange"), died at 8 days of age, and the finally, ("Yellow"), was found deceased at 9 days of age.

The final clutch of 10 eggs set for incubation were all laid by an unknown pair or pairs of ducks. This clutch included the nest of nine eggs found on April 28th as well as the final egg collected from another nest site on the same day. One egg had arrested development fairly early on in it's incubation, and two others were fully developed but failed to hatch. They were active and moving while other eggs were hatching, and necropsy showed they were positioned correctly, so why they did not hatch is unknown. That left the seven eggs that did hatch, (3.4 ducklings).

When the ducklings hatched they were left in the Reptibator until they were dried off. Once removed, our vet staff examined the umbilicus of each duckling. We gave each duckling a different color marking by painting a little bit of nail polish on the wing tip. This allowed us to be able to individually identify each duckling. The ducklings were weighed and set up in a brooder. Weights were obtained twice a day for the first month, then just once a day after that. They were closely monitored for activity and whether or not they were eating, how often, and how much food they were typically taking. If the ducklings were doing well by day

Photo 3. Newly hatched ducklings from Clutch 3

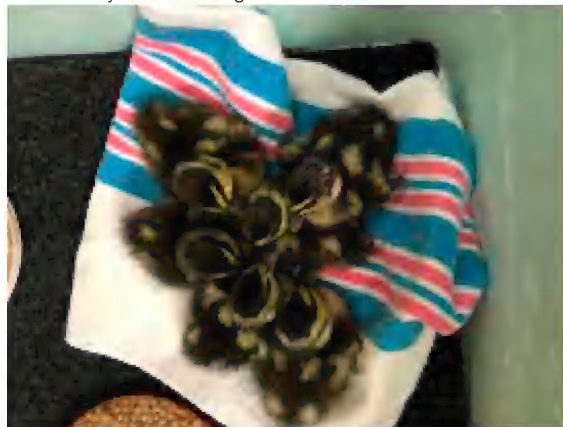


Photo 4. Ducklings at 3-days-old



3 they were pinioned. A number of ducklings weren't as strong or as big as others, so we waited longer before pinioning them to make sure the procedure was not going to be detrimental to their development.

Initially their food (Mazuri® Waterfowl Starter) was moistened and offered in small lids. As the ducklings grew they were given larger dishes with water and food and after they were two weeks old they were moved to a larger brooding tub and introduced to a small pool. As they continued to grow the amount of water they were given to swim in was slowly increased until they had to be moved to a larger holding rather than the tub they had been in. When the ducklings started molting and getting their adult feathers we began transitioning them to Mazuri® Waterfowl Breeder, which is what our waterfowl on exhibit are fed. When the ducklings began molting the feathers that had been painted with nail polish, zip ties were used as temporary bands to allow individual identification.

At a month and half the oldest three ducklings were introduced to the next clutch of four ducklings. There was about a 10 day age difference between the ducklings. The ducklings were moved to our flamingo barn to begin introductions to the exhibit and exhibit residents. We modified the flamingo barn for duck holding by enclosing the space directly outside of the barn and fully fencing it in to ensure predators would not be able to access the birds. Initially the ducklings spent just an hour or two down at the exhibit, but as they built up their confidence they were then moved down in the morning and spent the day at the exhibit and returned to the anteater barn at the end of the day. It was when a duckling was found deceased at the flamingo building one afternoon that this introduction process was halted until it could be determined why the duckling, which had been thriving, had suddenly died.

Conclusion

Of the 30 eggs I started with 21 hatched. Of the nine eggs that did not hatch, three were confirmed infertile during candling, two more had fungal spores inside so, if they were fertile they did not develop, two eggs had early arrested development, and two eggs had fully developed ducklings that never hatched.

Eight of the 21 ducklings did not survive, five did not survive a week, two more lived just over a week, and the final one was close to two months old when it died. The first duckling found deceased was "Black." Results from necropsy were consistent with omphalitis, (a bacterial infection of the umbilicus), and possibly secondary bacterial septicemia. "Glitter" was the second duckling that was found deceased. Necropsy results

revealed a presumptive diagnosis of hemorrhagic enteritis. The next duckling found deceased was "Pink." Necropsy showed this duckling had multifocal calcification of the heart as well as septic dermatitis and cellulitis. The next two ducklings "Maroon" and "Pale Purple" both died from Aspergillosis per necropsy reports. "Yellow" and "Orange" were the next two ducklings that died. Both were consistent with pneumonia per necropsy findings. The oldest duckling found deceased, "Blue," was found to have fibrinoid necrosis in the liver most often described with septicemia, possible mycoplasma infection, and proventriculitis. Currently I still have 13 ducklings that are still in the process of introductions to our lagoon exhibit.

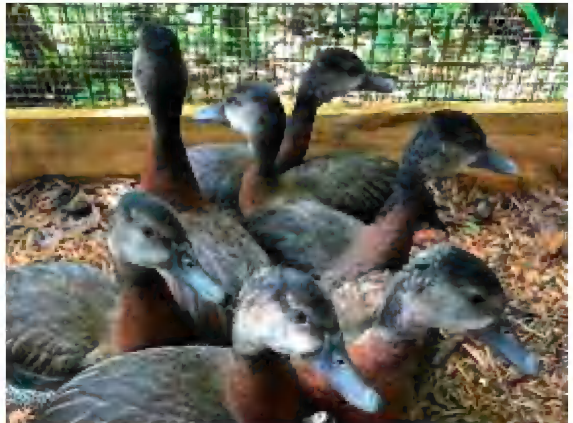
I completed the majority of the incubation process with help from my relief keeper on my days off. Much was learned during this process, though my success rate of ducklings surviving increased by the final clutch, the set-up was far from ideal for incubating and hatching birds. The anteater barn where the incubation, hatching, and brooding took place is a large open space. There was no way to keep the dust and debris that gets kicked up by the anteater from getting to the incubator, and brooders. Two ducklings died from Aspergillus which could have come from the mulch or rotted logs in the anteater holding. Also when we service the exhibit we go through the barn, so everything cleaned from the exhibit is hauled through the barn past the eggs and ducklings. With all the potential "contaminates" that could cause issues for the eggs and ducklings it was difficult to keep the incubation/brooding area clean. For future artificial incubation I will fully disinfect the incubators between clutches. Also, better ways to sanitize the eggs prior to being placed into the incubator will be investigated.

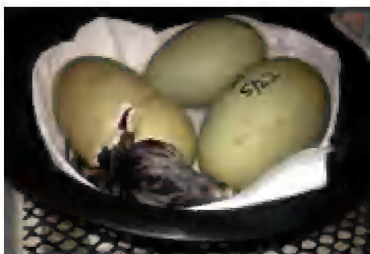
Increasing the biosecurity of the incubation and brooding space is a priority before this process is started again. To reach this goal we will be constructing an incubation room in the barn in order to control the air flow and keep the area more sanitary. Having a closed room for incubation would also allow for better control of the humidity in the room. The barn currently has open windows and exhaust fans that pull outside air in through the barn. This of course causes the barn to have pretty dry air which we believe was why we had such a challenge reaching and keeping the desired humidity levels for the incubators. An enclosed room would solve these problems. The one big plus about all this occurring in the anteater barn was the barn was warm and holds a pretty steady temperature during the warmer months. I will admit this was emotionally exhausting for me, but I do look to take what I learned from this process to increase future success of artificial incubation at the Greenville Zoo. 🌱

Photo 5. One-month-old ducklings



Photo 6. Introductions at the exhibit





Incubator-hatched chicks are more suitable for hand-rearing than their parent-hatched counterparts. Pictured here is a Common Eider.



A dry brooder with a wire floor. Notice the Plexiglas® on the brooder walls to prevent ducklings from climbing out.



An example of a larger wet brooder used for ducklings large enough to spend their days outdoors.

An Introduction to Hand-rearing Waterfowl

Ian Gereg
Curator of Birds
Philadelphia Zoo

Hand-rearing waterfowl can be an enjoyable and rewarding experience if well-planned and executed correctly. Starting out with incubator-hatched birds is always preferred, as chicks removed from their parents are nervous and are challenging to settle down and encourage to eat.

For all waterfowl species getting the chicks to start eating is the first hurdle. One of the most readily accepted starter diets in my experience has been Mazuri's® waterfowl starter diet. While palatable to most chicks as-is, I have best results when the pellets are slightly softened with water. For the more challenging species (such as sea ducks and stifftails), a mixture of 60% Mazuri® waterfowl starter and 40% hard-boiled egg has been helpful. To make the mixture the waterfowl starter is briefly soaked, then the excess water is poured off. While the starter sits, the pellets are put through a food processor until finely chopped. Afterwards, the eggs are thoroughly mixed with the moist waterfowl starter. If kept refrigerated this mix will last 4-5 days. After about a week the percentage of duck starter can be increased until the egg is completely removed from the diet.

Along with their commercial diet, all young waterfowl should have access to greens. Even if not consumed the leaves offer a great enrichment item, particularly in water. Goslings, cygnets and shelducklings should get finely chopped lettuce or dandelion greens

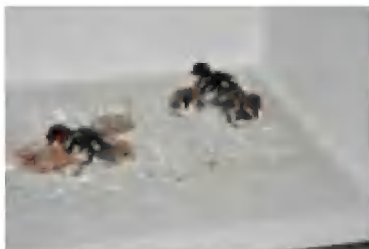
from the start, and gradually transitioned to larger pieces during their first week. By their second week they should be spending their days outdoors exercising and grazing barring unsuitably wet or cold weather. In the evening goslings and cygnets should also be given greens to satisfy their grazing urges.

Sea ducks and stifftails benefit from (and for some species I would go as far as to say *require*) the addition of natural food items for them to start eating. Frozen bloodworms and chopped krill are often suitable. These items should be fed in the water and these species tend to fare much better in wet brooders (more on those later). Merganser ducklings instinctually respond to movement and start feeding easily on small fathead minnows (also of the "rosy red" type) as well as krill and bloodworms. Some breeders are also keen on mealworms and duckweed as starter diets for waterfowl, but I have found mealworms to be particularly challenging to wean chicks off and duckweed (at least the plants collected from the "wild" can contain potentially harmful bacteria and parasites).

Chicks should be left in the hatcher for 12 to 24 hours after hatch to dry off and get their bearings. When in doubt about whether a chick is ready to move from the hatcher, give it more time. Once ready to go, the species you are working with comes into play. While all species (with the possible exception of the Hawaiian Goose) will prosper when "wet brooded", goslings, shelducklings, and whistling-ducks and dabbling ducks do not require it. These species can be placed in "dry brooders" with access only to drinking water for the first few weeks of life.

In both wet and dry brooders heat should be provided to one area but not all of it, preferably near but not over the food and water. Initial temperatures should be near 90F but can be backed down by 5-10 degrees a week thereafter. Chick behavior should dictate the temperature in the brooder. If the birds avoid the area directly under the lamp it is too warm; if they are piled in a heap directly under the lamp it is too cold. Ideally chicks should be spread out under and around the lamp's rays.

Substrate for dry brooding can be wire, vinyl coil mat or paper towel, but absorbent, slick (newspaper) or ingestible (pine shavings) floors should be avoided. Water should be offered in something that the chicks can't get soaked in and commercial chick "founts" work well for this role. A chick fount with a hole drilled in the top or side to accept a hose allows for a



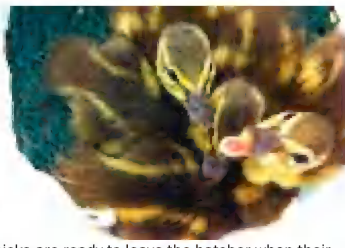
Day-old Scaly-sided Mergansers foraging for bloodworms and minnows in a wet brooder.



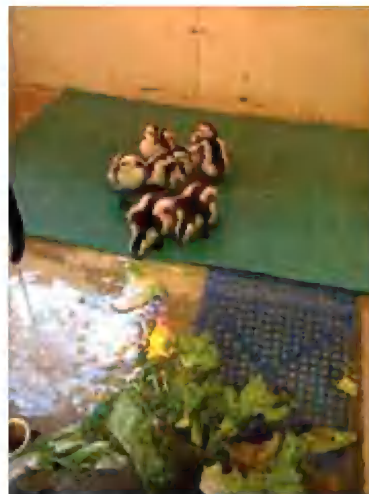
Daytime grazing pens.



An alternative style of daytime grazing pen. This style has a concrete pool and overflow.



Chicks are ready to leave the hatchery when their down is dry and they are alert and active. Pictured are South American Comb Ducks.



Several styles of wet brooders. (above and below)

constant trickle of water which helps prevent the chicks from running out of water. It also helps keep the water clean and attracts the chicks with the movement and sound of dripping water. Food should initially be offered on paper towel as well as in the water. The chicks will naturally seek out the water and will initially search for food there too. If a trickle of water has been added to the fountain you may find that the food rolls out of the water onto the floor as soon as the chicks start feeding. Drilling very small holes around the top lip of the fountain base allows the water to flow through while preventing the food from falling over the top lip. Once the chicks are determined to be eating well food can start being offered in a dish near the water.

Within a week, if the weather allows, dry brooded chicks can be moved outdoors for the daylight hours. Movable "grazing pens" allow the birds to exercise and forage naturally. Covering half the top of the grazing pen with rubber mat or other roofing allows for some peace of mind should an unexpected thunderstorm roll through while the chicks are outdoors. Food and water can be provided similarly to how they are offered in the dry brooder.

The ducklings of stiff-tails, pochards and sea ducks require different treatment to achieve the greatest success. These species are more aquatic and should be wet brooded.

Unlike dabbling ducks and other dry brooded species, these species should be introduced to swimming water directly from the hatchery. The thought that ducklings get their waterproofing from their mothers is a misnomer; their waterproofing (for the first few days at least) actually comes from the static qualities of their dense down. So long as the water is free of surface dirt and oils even hours-old ducklings can swim and dive while remaining dry.

There are a variety of wet brooding options ranging from specially-made fiberglass brooders to home-made tote conversions. Some breeders even create custom concrete floors and shelves containing small pools. No matter how they are built, all share the same basic idea: a pool of clean, flowing water and a dry, heated area. Ducklings are more likely to start feeding when their diets are placed in their water, though once they are eating it is important to start to offer them their diet on dry land too so they will eventually transition to it (a process that can take several weeks). Heat lamps should be started at similar temperatures to those for dabbling ducks but the heat and water combination can create high humidity which can affect duckling's ability to dry off. Some breeders have taken to hanging box fans over their wet brooders to keep a constant flow of moving air blowing down (or across) the brooders which seems to keep the wet-brooded ducklings dryer.



By 3-4 weeks of age, depending on weather, wet-brooded chicks should be moved outdoors to pools that allow them to spend most or all of their day on the water. Food should be offered near or in the water as it was in the wet brooders.

Photos by Ian Gereg.

Nest Sites for Waterfowl

Ian Gereg
Curator of Birds
Philadelphia Zoo

The nest sites selected by wild waterfowl are as diverse as the species themselves. Fortunately, most species will happily accept man-made nest sites which can be strategically placed to best ensure breeding success.

The first step to understanding the nesting preferences of the species you are working with is to review the literature describing their natural nest locations. Suggestions for finding that information includes Kear's two-volume *Ducks, Geese and Swans* (2005) and the online Handbook of the Birds of the World Alive (www.hbw.com). Islands are preferable as nest sites for most species, providing increased protection from land predators and greater availability of escape routes back to the safety of the water. With all waterfowl, multiple nest sites are preferred and a rule of two nest sites per breeding female is helpful to follow. Avoiding placing nest sites in low sites prone to flooding, and around areas of high traffic (feeding areas, keeper entrances, etc.) can reduce the risk of nest abandonment later in the season.

Nesting material for ground nesting species can include straw (avoid hay as it molds and decomposes quickly), Spanish moss, dried leaves and dried ornamental grass stems. Keepers should also remember that waterfowl do not carry nesting material long distances (most only using what is within bills-length) so material must be situated accordingly. Solid-sided and elevated nest boxes should have ample nesting material to pad the eggs from the hard base of the box. Pine shavings, pine straw, dried leaves, chopped straw and Spanish moss are all suitable options.

Swans create large mounds of material for their nests and require little more than the vegetation to build with. Their high nests help protect the eggs from flooding and give the incubating bird a better vantage point of the surrounding wetlands. Most nests are placed at peninsulas near the banks of a pond and in aviculture these locations are also preferred. Regardless of preferred nesting location, the placement of nest material strongly influences nest site selection. Once a pair of swans has selected a nest site, more nest material needs to be provided for the mound to reach maximum potential. Swans rarely use nest structures and do not require them, but swans have been known to nest under shade covers or inside three-sided buildings when nest material was exclusively provided there. Similar to the swans, Magpie Geese prefer nest sites of mounded vegetation, often placed on top of unfortunate reeds or low shrubs. Both swans and Magpie Geese prefer to nest on the water's edge or close to it.

Like the swans, the "northern geese" (*Anser* and *Branta* species) typically nest out in the open in the wild, utilizing dips in the landscape or rock formations to break up their outline. In aviculture they take a variety of nest sites that replicate the "hidden in plain sight" concept. One of the most common is the slatted nest box, which is three-sided and provides the incubating bird with a view outwards between the horizontal boards. These boxes, sized appropriately for the species, are readily accepted by a wide variety of geese. Easier to construct and equally popular are circular arrangements of rocks with a shallow depression between them that allows the incubating bird to sit low,



A Baikal Teal nesting in a low, open-faced nest box lined with straw placed on the ground.



A Cinnamon Teal nesting in daylilies.



A female Long-tailed Duck nesting in a depression underneath an evergreen.



A female North American Ruddy Duck nesting in dense lilies on the water's edge.



A Hawaiian Duck incubating from within an elevated porch-style nest box.



A low, open-faced nest box style often selected by sea ducks.



A Lesser Scaup sitting atop a woven nest of iris leaves in a planting bed.



A nest box built into a mound for shelducks.



A Lesser White-fronted Goose using a slatted nest box. Note the pitched roof. This particular bird is nesting inside a shed.



A New Zealand Scaup nesting in an elevated porch style nest box.



A long, double entrance box used by shelducks.



A partial clutch of Baer's Pochard eggs in a nest made from grass and straw, tucked under a mulberry bush.

triangles of low logs arranged horizontally, and hollow stumps dug slightly into the ground. All provide the sitting bird with a good view of the space around them while also allowing them to flatten out and disappear from sight when alarmed. Despite the option of shaded, tucked away locations some geese commit to areas of greater sun exposure than one would wish which brings up the concern of the eggs (and potentially the incubating bird) overheating. Fortunately, once incubating for more than a few days most geese are committed to their duties strongly enough that an a-frame plywood shade can be placed over the nest. Bound to the water for gosling safety after hatch, most geese nest within a few hundred feet of water.

The shelducks and sheldgeese have requirements unique enough to merit their own discussion. Sheldgeese nest in rock crevices, dense sedges and other sites more concealed than most northern geese prefer. In captivity sheldgeese choose solid-sided nest boxes, including A-frames with open fronts or those with half-fronts. They also take to log teepees placed vertically in aviary corners. Uniquely amongst the group, Orinoco Geese typically select elevated nest sites, preferably with ramps or ladders leading up to them. Shelducks seek even darker, more secluded sites for their nests and select in tree hollows, rock piles, abandoned mammal burrows and other dark, confined spaces. Birds in zoos will accept buried or partially buried nest boxes, ground boxes with elongated tunnels, and in the case of Radjah Shelducks, primarily elevated nest boxes. Like the northern geese, sheldgeese and shelducks prefer to nest within a few hundred feet of a waterbody.

Whistling-ducks were formerly called "tree ducks" which gives you an indication of where many of them choose to nest and roost. Despite their long legs, many species take to hollow tree limbs and other arboreal nesting options in the wild, though nests in dense cover are also noted. Fortunately in aviculture the whistling-ducks are not particularly choosy about their nest sites and will take to heavy plantings, solid-sided ground boxes as well as elevated boxes, planters and other higher platforms.

In all of the aforementioned species males take an active role in nest site defense and brood care. While incubating, birds can sometimes be difficult to find. Watching for an alert and often calling mate nearby can help indicate your proximity to a hidden nest. When you've approached too closely expect a reprimanding from both adults, particularly from the geese and swans.

The dabbling ducks are probably the most adaptable of the waterfowl when it comes to nest sites. Most are ground nesting but aren't picky about their options so long as they are well concealed. Nest sites can range from a more natural dense vegetation (daylily, pachysandra, lirioppe) to slatted nest boxes tucked into vegetation or solid-sided boxes placed on the ground. Surprisingly, many dabbling ducks also take to elevated nest boxes if there is easy access in the form of a ramp. Solid-sided nest boxes come in a variety of shapes and sizes, with one of the most common being the "porch" style box. Designs for such a box can be shared by the author. These boxes can be placed on the ground or elevated on a 4"x 4" post, typically at 4' or less. Nest sites are not as bound to water as one might expect for such hydrophilic species and can be a hundred feet or more away.

The pochards, or diving ducks, are slightly more bound to natural vegetation than the dabbling ducks and most choose sites in dense grasses, sedges and other ground cover within a hundred feet of water. While some species will also readily take to solid-sided ground boxes, others prefer slatted boxes tucked into vegetation while others choose no box at all. Canvasback, the scaup species, Ring-necked and Tufted Ducks all prefer to make natural, often complexly woven nests in dense cover whereas Rosy-billed, Red-crested and Redhead readily take to ground boxes. Surprisingly, some pochards, particularly New Zealand



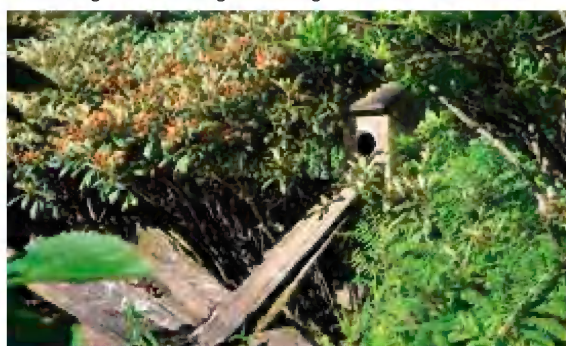
A Smew incubating inside a wood duck-style nest box. This model has a side inspection door.



A three-sided A-frame nest box, well concealed with ornamental grasses and branches.



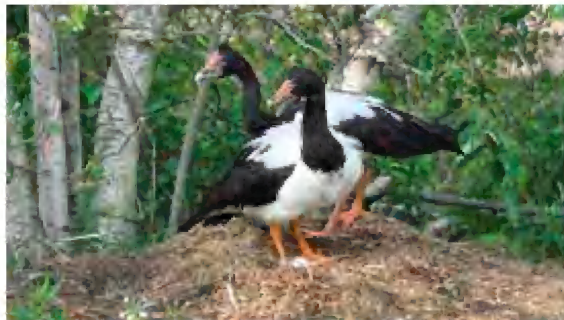
A White-winged Scoter nesting in dense vegetation.



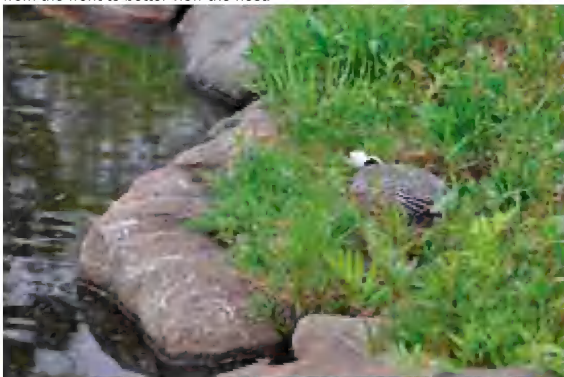
A wood duck-style nest box used by Harlequin Ducks. Note the concealed location and access ramp.



An Ashy-headed Goose nesting inside a log tepee. One log has been removed from the front to better view the nest.



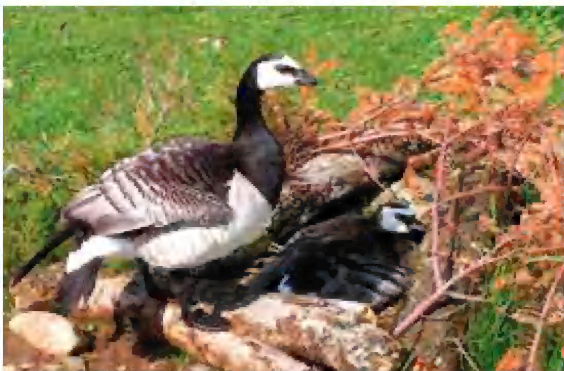
Like swans, Magpie Geese build a mound of grass and other vegetation.



An Emperor Goose nesting in a depression along the water's edge.



Simple arrangements of rocks with a depression within a hollow log are attractive to northern geese like this female Red-breasted Goose.



Barnacle Geese nesting in logs laid horizontally in a triangle shape.



The exterior of another porch style box - lid removed for photo.



Black Swans at their nest underneath a shelter.



The inside of a porch style box showing ramp, porch and nesting area.

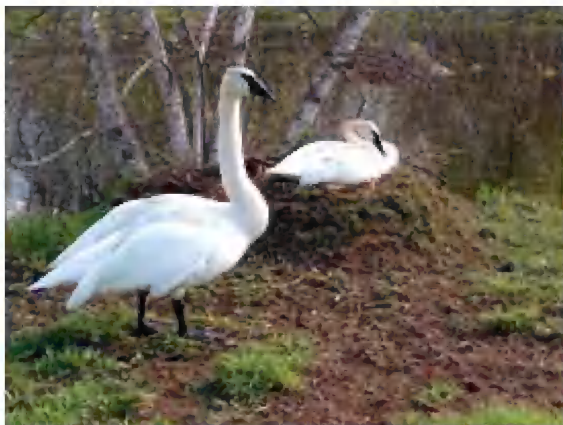
Scaup are inclined to nest in elevated boxes if ramps are provided. A word of caution: less agile on land than dabbling ducks, pochards can more easily get trapped in deep elevated nest box cavities should they fall in while searching for next sites.

"Perching ducks", a loose group of the wood ducks, pygmy geese, ringed teal and other species that nest in tree cavities in the wild tend to carry this behavior into zoo life as well. The same "porch" style nest box is a good start for most species, as are derivations of the wood duck box used by wildlife managers. Some species, like the pygmy geese, seem to prefer natural sites, including hollow wood or palm logs. Nest sites should be placed at least 3' off the ground, but going exceedingly high is not necessary. Eight feet or less is suitable for all cavity nesting species and safer for all who need to inspect the box.

The sea ducks are a diverse lot when it comes to nest site selection. The mergansers, with the exception of the Red-breasted, are cavity-nesting and choose hollow logs and holes in river banks above or near water. The goldeneyes (including the Bufflehead) also nest in tree cavities, though the Barrow's Goldeneye will also occasionally nest on the ground. The remainder of the sea duck tribe, including the eiders, scoters, long-tailed duck and the harlequin duck tend to nest out in the open, underneath low vegetation, or in piles of driftwood or other debris. The one exception is the harlequin duck which will also occasionally nest in elevated sites so long as there is easy access in and out of the box via a ramp. Fortunately these preferences are relatively simple to replicate in aviculture. Elevated porch or wood duck-style nest boxes work well for the mergansers. Slatted and three sided boxes as well as jumbles of driftwood work well for the eiders and red-breasted mergansers. Long-tailed ducks, harlequins and the scoters tend to nest under shrubs and evergreens but will also take to low three-sided or slatted boxes on occasion. Harlequins have also been known to nest in wood duck-style boxes if well-concealed but easily accessible. Most species prefer to nest within 100 feet of the water.

Rounding out the family, the stifftails, including the North American Ruddy Duck, Argentine Blue-billed Duck and White-headed Duck are the most aquatic of waterfowl and choose to nest either on floating mats of vegetation or in the dense reeds along the water's edge. In an aviary they also choose to nest in close proximity to water, and while they will still seek out natural vegetation, they will also take to solid-sided nest boxes. Boxes should be placed so that interested females can enter them from the water (or within close proximity) as they are awkward on land and seek the safety of the water when threatened. When setting up boxes for these species be careful to minimize the slopes and even lips on the edges of nest boxes, as even slight barricades can discourage a gravid female stiffail.

Photos by Ian Gereg.



Trumpeter Swans incubating on a nest mound made from moss and straw.



Spotted Whistling Ducks inspecting a natural log nest site.

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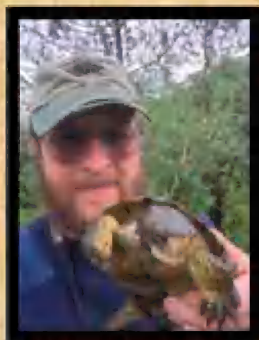


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Keeping Water Clean

Ian Gereg
Curator of Birds
Philadelphia Zoo

Keeping water clean in a waterfowl aviary can seem like an uphill battle. After years of trying various remedies, I've found a few effective and economical solutions that other waterfowl keepers might find helpful. Before we get in to how to keep water clean, let's back up and deal with the basics. Not all waterfowl need the same quality water. Dabbling ducks, pochards, geese and swans are generally not picky about water and usually will not suffer from plumage issues unless the water quality is exceptionally poor. The exceptions are Baikal Teal and Falcated Ducks that have, in my experience, had trouble with picked breasts in water that

other dabbling ducks would find acceptable. The sea ducks, including the eiders, mergansers, and scoters are the most problematic and require water of higher quality than most other species.

Providing quality water includes tackling suspended and settled solids, algae, bacteria, temperature and surface debris. How each is treated depends on the type and size of your pond, how many birds you have, your geographic location and sun exposure, as well as how you dispose of excess water.

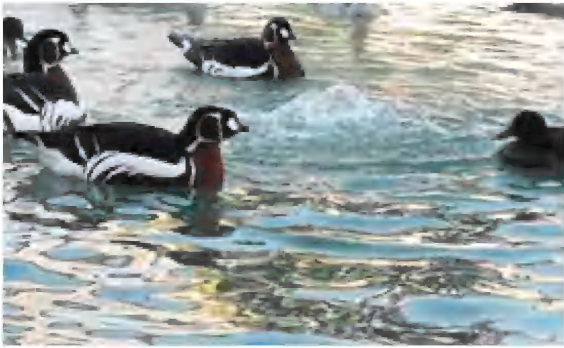
In my experience the most frequent cause of poor waterproofing and wet feathers is not so much the material in the water but the material on the water's surface. Have you ever looked at your duck pond on a sunny day and seen what looked like an oil slick? Natural oils from the feed, aviary and the birds themselves build up on the surface of your pond. Like the water line stained on a boat, the parts of your duck's plumage that are exposed to the water's surface get saturated with these oils. This is especially prevalent on the breast which is most exposed to surface oils as the bird plows through the water. These oils can greatly compromise the insulating properties of the feathers and reduce waterproofing. To prevent these issues, waterfowl bathe daily and spend a lot of time preening. When the surface of the pond is excessively oily, birds work harder to remove the contamination, particularly from their breast, and over-preening can result. Once the breast feathers are worn from over-preening they begin to allow water to contact the skin on the breast which can result in awkward paddling, rearing out of the water and more over-preening. The over-preened feathers are unfortunately beyond repair and will not be replaced until the next molt. Manually removing the damaged feathers can expedite their replacement but unless the water quality has improved the same scenario is more than likely to occur again.

Natural ponds tend to have the least maintenance. The water in a natural pond is a living soup of bacteria, algae and other microorganisms that assist in the breakdown of waste and natural oils. Aquatic plants and insects, snails and mussels, as well as some species of fish also help keep a healthy pond ecosystem clean. So long as the waterfowl population does not exceed what this pre-existing ecosystem can support the majority of the work keeping the pond clean will be done for you.

Concrete and liner ponds do not have the benefit of a team of aquatic animals and plants ready and willing to digest what your birds leave



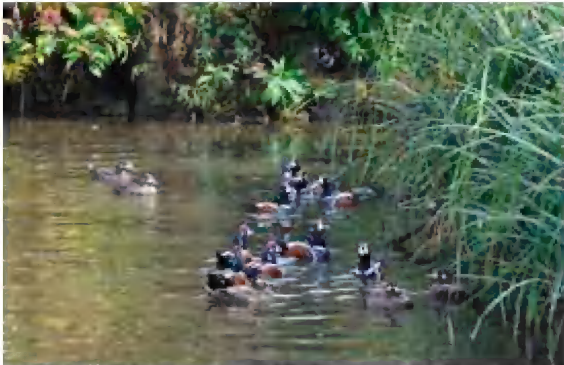
Baikal Teal drake. Photo by Ian Gereg.



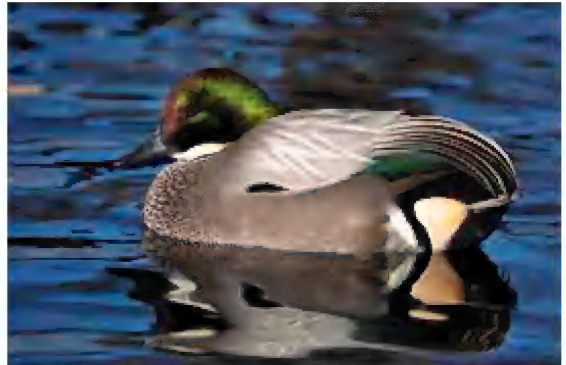
An aerator creates waves that push surface oils and debris to the pond edges.



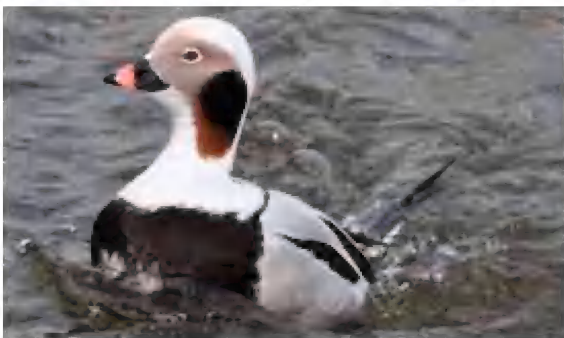
Daily bathing and preening rid the plumage of contaminants that can impact insulation and waterproofing.



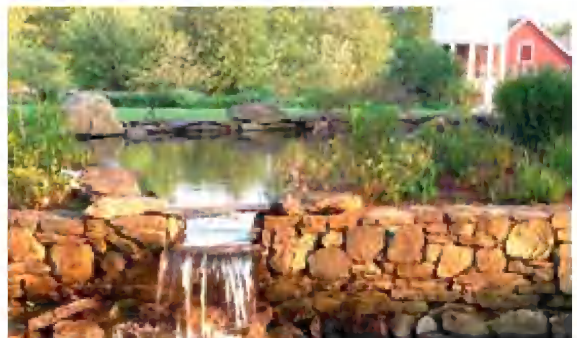
Natural pond water has many benefits to waterfowl but can also be problematic.



Pond dye blocks sunlight from reaching the depths of your pond where algae needs it to grow. It does not stain plumage.



A male Long-tailed Duck with the beginnings of a picked breast. Note the location of the water line in relation to the picked area.



A spillway is an excellent location for a simple filter screen set up.

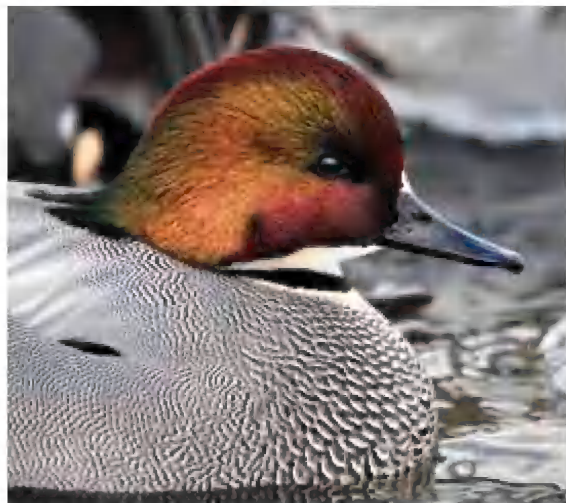
behind, but they do have many benefits. One is that they can be easily drained and cleaned thoroughly. Another is that they tend not to have the parasites that your birds can pick up in a natural pond. Pond water is alive and can contain bacteria, parasites and potential contaminants that could be harmful to your birds. For example, I experienced frequent issues with tracheal and liver flukes in sea ducks kept on natural pond water. The intermediate host was a snail, which comes in with the pond water to feed on algae. Other groups of birds like dabbling ducks, swans and geese thrived in the same water.

Regardless of what type of pond you have, a constant flow of water, even if just a trickle, is the most effective means of providing the highest

quality water. The constant flow prevents surface oils and debris from building up. The flowing water also dilutes algal concentrations and keeps the water cooler which also helps keep algae growth down. The problem with a constant flow though is that the excess water needs to go somewhere. Not everyone has somewhere to put the water once it leaves their pond. If you are fortunate to have access to a constant flow of water, there are several means of disposing of your excess. The first is to drain the overflow into a field where it will be diffused through the soil. The second is to create a sort of settling pond where excess water flows into. Over time this pond will develop wetland plants that help filter nutrients out of the water and helpful bacteria that break down waste from your aviaries. An additional benefit of a settling pond is that the



Male Baer's Pochard



Male Falcated Duck

water can be recycled and pumped back into your aviary to create a closed circuit water system complete with natural filtration.

Aquarium or pool-style filters are typically not an option in waterfowl ponds because feathers and other debris quickly clog filters. A simple alternative is a spillway that pours into a catch basin containing a submersible pump. A fine mesh screen covering the catch basin can be used to protect the pump from feathers, leaves and other debris as they pour off the spillway. Like all other filters, even a rudimentary one like this needs frequent upkeep, especially during molting seasons when loose feathers are especially prevalent.

If flowing water is not available for your situation, there are other options. Aerators push air to the surface of the pond, agitating the water and sending constant ripples across the water's surface towards the pond banks. This not only gets oxygen into a stagnant pool, but equally important, the ripple action pushes surface debris (oils especially) to the edges of the pond. As explained earlier, oils on the surface of the water are the biggest cause of poor plumage and feather picking in the breast area. Aerators also double as effective de-icers in northern climates too. Wet or picked breast feathers are generally more common (and problematic) in sea ducks than in other waterfowl, but species like Baikal Teal are notorious for this ailment. For many years all of the Common Eider that I kept had picked breasts and the awkward water treading that comes with a duck with a cold, wet belly. After installing aerators that dealt with the surface oils I never had a problem again.

Algal growth is typically an aesthetic problem and not an issue to waterfowl. That being said, it is usually a condition that comes from heavy nutrient loads and warm water, two things that can also breed dangerous bacteria. Draining a pond, removing all the bird droppings which contain the nutrients algae needs to grow, and rinsing the pool clean is a quick and effective remedy. Bleach can be sprayed directly on algae and is especially effective on removing light growth. Heavier growth needs to be pressure washed or brushed loose before bleach can be effective. In my experience bleach exposure has not been an issue with waterfowl when used in a 10% dilution.

Another means of dealing with algae growth is pond dye. Most of my experience has been with black colored pond dye, which is produced for reflecting pools and koi ponds to create a dramatic visual effect and to reduce algal growth. It works by blocking sunlight from reaching deep into the pool. Algae needs sunlight to grow so a dyed pool stays nearly algae free.

Exposure to mud and dirt also causes cloudy water. Waterfowl relish an opportunity to dabble in the mud, and bring back profuse volumes of mud to your pond in their bills and on their feet. Lining several feet of the pond bank with stone or textured concrete prevents mud from building up around the edge of a pond where your birds will have easy access to it. Not only will mud cloud your pond, it also contains potentially harmful bacteria like those that cause the infamous avian tuberculosis. Keeping waterfowl clean and out of the mud is an effective way to reduce tuberculosis exposure.

One last way I've found to keep a pond cleaner is to consider your waterfowl feed and how you feed it. Oily feeds like dog or fish food can cause serious waterproofing issues on a pond without flow if fed on the water. Any milled feed should also be fed dry, near but not in the water. Non-porous feeds like grains and vegetables are safe for feeding on the water without contaminating it.

I hope my experiences have provided some clear solutions to your murky water problems. If you'd like specific details on aerators, dyes or other means of keeping water clean please get in touch.

Photos by Ian Gereg. 

Editor's Note: An original version of this article was originally published in American Pheasant and Waterfowl Society Magazine, Issue 2, March-April 2016. Pages 9-12.

An Introduction to Keeping the Northern Geese

Ian Gereg
Curator of Birds
Philadelphia Zoo

The northern geese, also called the true geese, are divided into two main groups: the “black geese” (genus *Branta*) and “gray geese” (genus *Anser*). There are ten species of gray geese, including Graylag, Greater White-fronted, Lesser White-fronted, Bean, Pink-footed, Swan, Bar-headed, Snow, Ross’ and Emperor. The six species of black geese include the Canada, Cackling, Brant, Barnacle, Red-breasted and Hawaiian. Found only in the northern hemisphere, all but one species are migratory (Hawaiian Goose), with distinct breeding and wintering ranges. Several species are further divided into multiple subspecies, each of which have distinct breeding grounds. Subspecies may overlap on the wintering grounds (various races of the Canada Goose for example). Males and females of each species look similar, though some males are visibly larger than their female counterparts. Juveniles typically look like duller versions of the adults through their first winter.

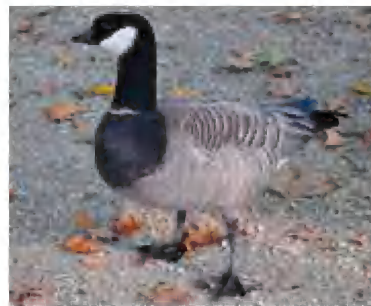
In aviculture both gray and black goose species have similar requirements and can be among the easiest birds for the aviculturist to maintain. Geese have many of the same basic needs as grazing livestock and thrive if treated as a “cow with feathers”. A pasture of tender, mowed grass will provide most of their dietary requirements and a shallow pond will suffice for bathing, roosting and mating. A commercial waterfowl pellet such as Mazuri’s® waterfowl maintenance, should be available as a supplement, especially during periods when grass is not as nutritious.

The northern geese are among the hardiest of all waterfowl and can survive exceptionally

cold weather unscathed so long as they are provided with access to open water (through the use of an aerator, stock tank heater, or flowing water). During the winter months geese thrive on a pelleted waterfowl diet (14-18% protein) supplemented with plenty of greens, including lettuce, broccoli, dandelion greens and green beans to keep your geese in great shape through the winter months. Other food items that geese enjoy throughout the year are white millet, wheat and whole corn, though none should be offered as more than a daily treat (5% or less of the total daily diet).

Housing geese is simple. Larger species can do well in open enclosures so long as they are safe from ground predators like foxes and raccoons. An electric fence is an excellent investment for this purpose. Their large size also reduces the risk of predation from hawks and owls. In my experience species as small as Barnacle Geese have survived long-term in open enclosures with open water for roosting, especially when in mixed flocks with larger species of geese. One exception are Hawaiian Geese, which inevitably fall prey to Great Horned Owls if kept in open enclosures, likely because they do not roost on the water at night like the other species and tend to wander around in the darkness.

In an aviary the small species like Red-breasted, Ross’, Lesser White-fronted and Brant make a nice addition to a mixed flock and are generally easier on landscaping than their larger cousins. These smaller species typically do not bully ducks or other aviary inhabitants but should be the largest birds in the enclosure to ensure they are settled



A Cackling goose x Barnacle Goose hybrid. Hybrids within the *Branta* genus are typically fertile.



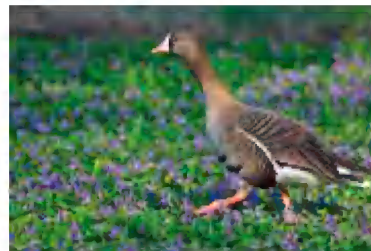
A cackling goose x lesser snow goose hybrid. Hybrids between *Anser* and *Branta* species are typically infertile.



A Pacific Brant on a nest along a fence.



An example of a *Branta* black goose, an Atlantic Brant.



An example of an *Anser* gray goose, a Lesser White-fronted Goose.



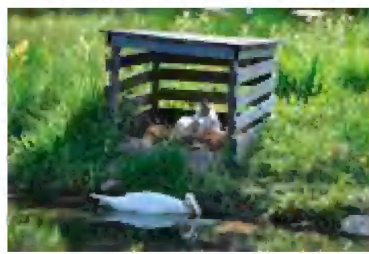
A Red-breasted Goose near her hollow log nest site.



A Western Bean Goose nesting inside a low pile of logs.



Outdoor grazing pens for goslings. Lightweight for easy movement and partially covered to protect from rain.



Greater Snow Geese using a slatted box as a nest site on a small island.

for breeding. Hawaiian Geese have been the toughest on aviary plants in my experience (grinding down even bamboo stalks) but too many geese of any species in too small an area will damage even the most goose-proof landscape design. Fencing with spaces too small for geese to get into around trunks and stems does a good job of protecting the most sensitive parts of plants. Rotating geese on and off grassy areas if possible helps prevent overgrazing. Certain plants are also more goose resistant, including phlox, monarda, day lilies, rhododendron, pachysandra, inkberry and most evergreens.

Breeding northern geese is also relatively straightforward, although some species are more challenging than others. All geese take at least two years to become sexually mature, and some can take three or more. Islands and peninsulas are favorite nesting locations for geese in the wild and offering similar sites can greatly increase nesting attempts. Successful nests in captivity also include sites behind rocks, under shrubs and even in boxes. Nest structures don't need to be anything fancy – a slatted box, hollow log cut into narrow sections or an arrangement of logs or rocks to nest inside. Brant and Red-breasted are the most finicky breeders of the group, and even experienced breeders will have hit or miss seasons with them. Neither species should be kept with larger species of geese that could bully them. Having multiple pairs often helps encourage nesting but they should be kept in an enclosure large enough for each pair to establish and defend their own nest site.

If being hand-raised, a movable "grazing pen" that is half covered to provide shade and protection from rain while still providing access to the sun works well for this purpose. In the evening, goslings should be put in a brooder with plenty of greens – this will help to reduce feather chewing among the goslings. Some species like Ross' seem particularly inclined to graze on each other's down. Keeping problematic goslings warm with a non-light emitting ceramic heat lamp (like those marketed for reptiles) overnight also seems to help reduce the problem. Flooring for goslings should be durable and non-toxic because they will try to eat it. Flooring should also have plenty of traction to prevent leg injuries. Coated wire, Dri-dek and unbacked vinyl coil mat are all good options.



An indoor holding area suitable for keeping goslings overnight. Matting keeps goslings clean and dry. North American Ruddy Ducks pictured.

Geese are generally excellent incubators and parents. Incubation can be as short as 20 days for small species like Ross' and as long as 30 days for large subspecies of Canada Geese. Leaving the adult birds to hatch and rear their own young is a safe bet, especially if the family group can be isolated until the goslings gain some size and strength. Goslings should be fed a quality waterfowl starter diet (20% protein max) and tender greens. Like with adult geese, grass and other greens should be the bulk of the gosling's diet with commercial feed being offered as a supplement. Within a few days of hatching the goslings should be turned out onto lawn during the day so they can forage and exercise.

Goslings reared with early daily access to grass rarely have developmental issues like angel wing. Too much protein, rapid growth and a lack of exercise can encourage angel wing and other growth related problems. For those who use seamless bands or "rings" on their waterfowl, goslings need to be banded particularly early because of their large feet – as early as two weeks in Red-breasted, Ross', and Brant. If you are pinioning your goslings, do it early too. Ideally it should be done within a week after hatch. Goslings of multiple species should not be reared together. Once mature, geese reared in mixed groups are prone to pairing with birds of other species – a behavior that can be difficult if not impossible to break. Fortunately hand-reared goslings, so long as they are not reared as singles, do not typically have human imprinting issues as adults.

Hybrids are common within the two northern goose groups and also between the two. Hybrids between gray and black goose species are typically infertile, but hybrids within the gray or black goose groups can breed. Along with mixed-species broods of goslings, another situation that encourages hybrid pairing among geese is keeping unpaired birds of multiple species together. Several species can be kept together without major hybridization worries if all are well paired and any single birds are removed.

The most common medical issue with goslings is gapeworm, which is caused by the nematode *Syngamus trachea*. Gapeworm infections result when a gosling ingests earthworms containing the infectious stage of the parasitic nematode. Outbreaks most commonly occur after rain brings worms to the surface where goslings can find and consume them. Once hatched, the worms travel to the trachea where they mature and can cause irritation to the lining of the esophagus and in extreme cases can restrict breathing. Coughing, gaping and head shaking are the most common clinical signs of gapeworm infection. Fortunately oral treatments provide almost immediate relief in most cases.

Two other common medical issues that occur in goslings are coccidian (a protozoan parasite)

The northern geese make a beautiful and low maintenance addition to waterfowl collections

and bacterial infections. Coccidia outbreaks are prevalent where droppings from sparrows and other birds can be ingested by geese. Infected goslings are often lethargic and hunched over with mild diarrhea, but severe cases can have blood-tinged mucus-like diarrhea, or can even die suddenly. Treating coccidia is relatively straightforward but requires medication, sanitation and prevention from reinfection (reducing access to wild bird droppings).

Bacterial infections are common in captivity, especially during the warmer summer months. Symptoms of goslings suffering from bacterial infections depend on the bacteria causing the problem, but can include lethargy, increased breathing effort or unexpected death. While treating infected birds is possible with antibiotics, prevention is the best medicine. Frequent cleaning and disinfection (using bleach, for example) of feed bowls, pools, and brooders, along with a constant supply of clean, fresh water can prevent most outbreaks.

One of the best means of identifying the problematic pathogen is through collecting fecal samples and submitting them to your vet for analysis. Gapeworm can be diagnosed on fecal flotation and/or a wet mount slide of tracheal swab. Coccidia is best diagnosed on fecal flotation and bacterial infections require at least a gram stain (but ideally a culture and sensitivity).

Adult geese have very few medical issues. Certain species such as Red-breasted and Brant are sensitive to West Nile Virus at all ages. Vaccinations are recommended for those who live in areas where this virus is present. Tapeworms are another common parasite of geese and other grazing birds (and mammals). Healthy birds can sustain low levels of tapeworms without any ill effects, but in stressed or otherwise compromised birds the infection can compromise the health of the bird. Treatment of tapeworms is straightforward; an initial treatment of dewormer (that specifies that it treats tapeworm) to remove adult worms and then a second dose after two weeks to remove any worms that were developing during the first treatment.

The northern geese make a beautiful and low maintenance addition to waterfowl collections. Larger species can thrive along the edges of ponds and lakes, while smaller species can add color and diversity to an aviary. For more information on keeping geese and the individual goose species, consider purchasing a copy of the following books:

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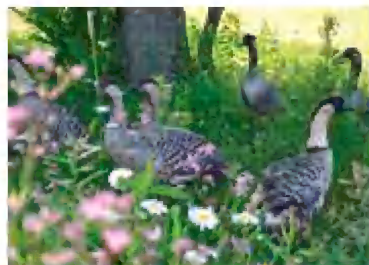
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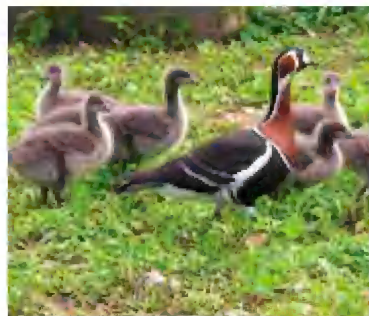
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Photos by Ian Gereg.



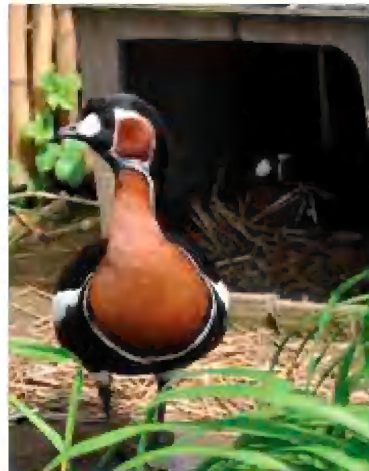
Hawaiian Geese are prone to predation if not in covered aviaries. They do not roost on the water like other northern geese.



Red-breasted Geese rearing their own brood.



Young Emperor Geese in a grazing pen. All goslings should be placed on grass as soon as possible.



Red-breasted Geese nesting in an open-faced nest box.



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Novel Social Groupings and Use of *In Ovo* Sexing as Population Management Tools for the Crested Screamer (*Chauna torquata*)

Joanna Klass, Zoo Keeper
Crested Screamer SSP Program Leader
Woodland Park Zoo, Seattle, WA



Dimitri and his family foraging at the Sequoia Park Zoo in Eureka, CA. Photo by Nate Krickhahn.



Dr. Tim Storms drawing a small amount of blood from the second egg.
Photo by Joanna Klass.



Dremeling with a 2mm diamond wheel point bit above the chosen blood vessel on the first egg. Photo by Mark Myers.

Abstract: The crested or southern screamer (*Chauna torquata*), is a species of South American waterfowl from the family Anhimidae. Crested screamers are currently listed as a species of Least Concern by the International Union for the Conservation of Nature (IUCN) and are a managed species under the Association of Zoos and Aquariums (AZA) Species Survival Plan® (SSP) program. Space is a limiting factor in the growth of many zoological animal populations. In order to ensure optimal sustainability within these populations, various management techniques and creative problem-solving must be utilized. Here we examine a blend of novel methods used for the management of this species based on the needs of the facility, the individual, and the well-being of the overall population.

Introduction: It's All About Space

Space constraints plague many SSPs, forcing programs to employ creative and sometimes ethically complex decisions. It is important to understand the ideal social dynamics for a species and what options may be at the Program Coordinator's disposal. The current number of screamers in the SSP is 106 (58.44.4). Historically, the number of males has been greater than that of females since the 1970s (Lynch and Klass, 2017). This bias, coupled with the traditional method of housing screamers in male-female pairs, has resulted in several single males being left alone.

Crested screamers are a monogamous species of waterfowl native to the wetlands of southern South America. The average lifespan in the wild is 15 years, though it can exceed 35 in captivity. Both sexes have identical plumage and cooperate with incubation and rearing of young. Chicks become fully independent at 12-14 weeks of age, though they can remain with their parents until the next nesting season. This species is naturally gregarious, forming flocks of upward of one thousand individuals during the non-breeding season and splitting off to form pairs in preparation for nesting. Single males may challenge established pairs, though many juveniles and unpaired individuals gather in flocks considerably smaller than those formed during the winter (Carboneras, Boesman, and Kirwan, 2017). This natural history should cause us to ask the question: should solitary males be housed alone, or are same-sex pairs and bachelor groups viable options as well?

Case Study: Same-Sex Pair at Potawatomi Zoo

Bachelor groups and same-sex pairs are utilized in several SSPs, though there are few, if any, records of North American facilities housing crested

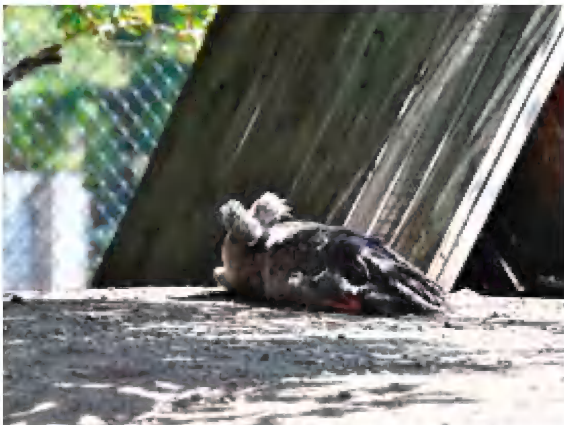
screamers in this fashion. Potawatomi Zoo in South Bend, Indiana recently held a solitary 15-year-old male whose mate had passed away. The lengthy wait list for a suitable female, the social needs of this species, and the presence of a 5,500-square foot alpaca enclosure provided an interesting opportunity to try housing an unrelated same-sex pair of crested screamers together. A two-year-old male from Sedgwick County Zoo was selected by the SSP to be paired with the older male at Potawatomi. In preparation for the introduction, two separate shelters and feeding stations were erected on separate ends of the habitat.

During the introduction, the younger bird was unloaded on the end opposite the older male's preferred location. The new male introduced himself with a loud vocalization, alerting the older male that another bird had entered the enclosure. A few hours passed uneventfully, with both birds loafing on their respective ends of the habitat. Gradually the new male grew more comfortable and began to explore his area until the older male made a deliberate approach. They eyed one another for a few minutes until the established male leaned his head forward and mock-charged the newcomer. Keepers reported that this displacement behavior occurred intermittently throughout the afternoon, with no observed physical contact. Since the only negative behavior witnessed was sporadic displacement of the younger male by the older male, it was decided to keep them on exhibit together overnight. When staff checked in the next morning, the birds were seen standing together while the younger male groomed the neck of the older. They have been compatible ever since.

Case Study: Older Sibling Helps Parents at Sequoia Park Zoo

The Sequoia Park Zoo in Eureka, California, recognized a situation that stresses how knowledge of a species' natural history and individual animals' temperaments can offer flexibility in management decisions at both the institutional and SSP level. When Sequoia Park Zoo's SSP-recommended pair produced offspring in 2016, one young male was unable to be placed elsewhere. Since staff had not noticed any aggression between the parents and the male juvenile, they considered keeping the family housed together. This same pair had previously allowed a two-year-old male offspring to stay with them through a nesting attempt where the eggs had been replaced by dummy eggs. It was uncertain how the addition of chicks would change the parents' behavior.

Keepers watched closely for telltale signs from the adults that would indicate the young male had overstayed his welcome, such as chasing,



The two males at Potawatomi Zoo in South Bend, IN have bonded remarkably well and are often found allopreening. *Photo by Jami Richard.*



A day after being introduced, the two males at Potawatomi are rarely seen apart. *Photo by Jami Richard.*

displacement, biting, and wing-slapping. As the 2017 breeding season neared, the adults began nest construction. To the surprise of the staff, the juvenile was seen assisting his parents. Although not allowed by the parents to incubate eggs, he helped in nest upkeep and defense. Once the 1.1 chicks hatched, the one-year-old male followed the family group as they foraged. Although the young male was not observed actively participating in teaching foraging behavior to his siblings, he acted as sentinel for the family.

In Ovo Sexing

A management technique that serves as a valuable tool in avian population management is *in ovo* sexing. Embryonic DNA is obtained by collecting blood or blood-tinged fluid by cannulating a blood vessel within the egg and submitting it for DNA sexing. This is ideally done near the halfway point in incubation for that species. A procedure for *in ovo* sexing based on methods from Dutton and Tieber (2001) was used at the Woodland Park Zoo (WPZ) with a clutch of three eggs from an SSP-recommended breeding pair of screamers. The intent was to select for female chicks due to an increasing number of surplus males in the population.

To the surprise of the staff, the juvenile was seen assisting his parents. Although not allowed by the parents to incubate eggs, he helped in nest upkeep and defense.

On the day of the procedure, three eggs were pulled and replaced with resin dummies at 25 days of the 42-46 day incubation period. The intent was to artificially incubate after sexing to prevent accidental puncture in the nest at the blood draw site and to avoid contamination. Viable eggs containing female chicks would then be returned to the parents at the time of external pipping for parent-rearing. While candling with a Lyon High-Intensity LED candle, it was determined that two out of the three eggs were viable. A black fine point Sharpie® was used to trace blood vessels that were large, close to the surface, and not near the embryo. Blood vessels near the air cell were also avoided due to the possibility

that the chick may attempt to pip near the sample site and be restricted from breaking through due to the Tegaderm™ patch.

Once the desired vessel was located, the site was cleaned with 5% chlorhexidine diacetate solution using sterile 3" x 3" gauze. The handler wore sterile latex or nitrile gloves from this point until completion of the procedure. A Dremel® Flexible Shaft Model 225 rotary hand tool with a 2 mm diamond wheel point bit was used to drill a hole in the shell over the designated blood vessel until the outer membrane was visible, ensuring that the egg shell membrane was not penetrated. Saline solution was periodically applied to the site via syringe while grinding to keep it from overheating. The area was again cleaned with 5% chlorhexidine diacetate solution just prior to cannulation.

A 0.5 mL insulin syringe with a 28.5-gauge needle was used, inserting it just below the surface at a shallow angle to the blood vessel. In this case, the vessel was not visible through the outer membrane with saline solution, so the needle was inserted blindly by following the lines drawn while candling. Approximately 0.03 mL of blood was collected and immediately deposited on a blood sample card provided by Avian Biotech International™ (ABI). Only a drop of blood or blood-tinged fluid is needed for sexing. Once dry, the sample cards were placed into a plastic bag and submitted to ABI for gender determination.

The sample site was again cleaned with 5% chlorhexidine diacetate solution and dried with a fresh piece of sterile gauze. A drop of Vet One™ surgical adhesive was applied directly to the hole in the eggshell and a 2.5-cm diameter circular piece of Tegaderm™ film was placed directly over the hole, forming a smooth seal to exclude potential contaminants. Tegaderm™ is a thin polyurethane dressing which is permeable to moisture and oxygen but not to bacteria and provides a barrier to external contamination while maintaining a moist environment beneath it. The eggs were then placed horizontally in a small portable cooler on a warm bed of millet and transferred to an Rcom Max20 artificial incubator. Incubation parameters were set at 36.9°C/98.4°F with 60% relative humidity and eggs were hand-turned 3-5 times daily.

Sexing results were received in one week: both embryos were males. Due to the needs and space constraints of the current population, these embryos were humanely euthanized by the WPZ Animal Health Department using carbon dioxide: a large hole was created in the

shell overlying the air cell of each egg, the eggs were placed within a chamber, and they were continuously exposed to carbon dioxide gas for > 3 hours before placing in the refrigerator. The screamer pair kept their dummy eggs until the end of their natural incubation period, after which they were pulled.

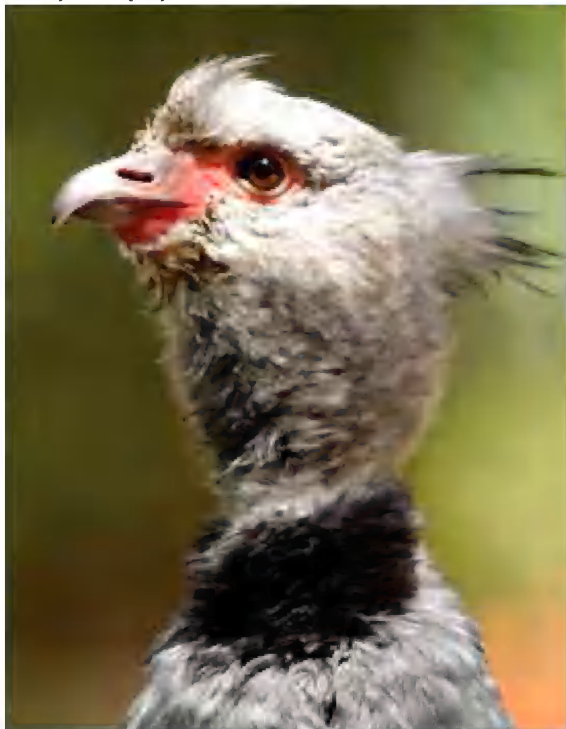
Conclusion

Ensuring maximum well-being of both the overall population and the individuals themselves warrants the use of multiple management techniques. Advancement of these methods must be an active process, evolving along with the best available science. Knowing the behavior of individual animals and the species' natural history is crucial when making decisions on potential social groupings. Space constraints and a facility's responsibility to provide optimal living conditions for their animals directly affect the amount of growth of a managed population. These factors require program coordinators to explore options for ensuring the sustainable genetic diversity of their populations and encourage managers to become creative and try potentially novel housing situations and population management methods.

Acknowledgments

Thank you to Jennifer Davis, General Curator, and the staff at Potawatomi Zoo, Amanda Auston, Animal Curator, and the staff at Sequoia Park Zoo, and Dr. Tom Jensen and Nicole LeGreco at the San Diego Zoo. I would also like to thank the staff at the Woodland Park Zoo, including Dr. Tim Storms, Associate Veterinarian, the Animal Health Department technicians, and West Team management and staff for their contributions to this article.

Crested screamer (*Chauna torquata*) at the Caldwell Zoo in Tyler, TX.
Photo by Robert Qually.



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Products Mentioned in the Text

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Bullies of the Duck Pond – Incorporating “Aggressive” Species Into Mixed-Species Waterfowl Exhibits

Ian Shelley
Collection Manager/Registrar
Salisbury Zoological Park

Dominance and aggression are relative terms which can vary seasonally. At the Salisbury Zoo's South American Duck Exhibit, Puna Teals often dominant Brazilian Teals. Their behavior roles reverse in the spring, however, as the Brazilian Teals prepare to breed. At this time of year, the Brazilian Teals become much more assertive, driving the Puna Teals away from their preferred nest sites.



Waterfowl are seldom displayed alone. In zoos they are almost always seen as part of a mixed-species exhibit, whether with other waterfowl species, other birds, or other taxa altogether. Through decades of trial and error, some species have earned reputations as being exceptionally aggressive to exhibit-mates. Unfortunately, this has led some facilities to decide against maintaining some species in breeding pairs, or against housing those species altogether. This in turn can pose a serious obstacle to the long-term sustainability of zoo waterfowl collections.

When I took on the program leader position for the Spotted Whistling Duck, only three zoos were involved in the studbook. The greatest challenge I found in getting more zoos to work with this species was the duck's rather unsavory reputation as a bully.

Even the most notorious waterfowl bullies, however, have been successfully incorporated into aviaries with other waterfowl. What makes some exhibits successful, while others fail? Part of the equation will always be the individual birds involved. Still, there are steps that can be taken to set your exhibit – and your birds – up for success.

Space – The first, perhaps most essential step is to make sure your aviary is large enough for the birds to be housed there. A large exhibit will allow less-assertive birds to share space with more dominant species without unnecessary

The Spotted Whistling Duck is a program species of the Anseriformes TAG, currently managed as a Red SSP. One of the challenges of managing the population of this duck has been overcoming its reputation as a bully in mixed-species exhibits, a reputation which is shared by many other waterfowl species.



stress. This includes land space and water space; it doesn't matter how big your aviary is if all your ducks are crowded into one small pool.

Flight Restriction – In the wild, birds can fly away to avoid an aggressive interaction. In a zoo setting, a pinioned or feather-clipped bird will find itself unable to do so. In some aviaries, it may prove practical to feather-clip a more dominant species upon introductions, leaving them less able to pursue fully-flighted birds. By the time the more dominant species has regained its flight abilities, the birds will hopefully have settled in together.

Vertical Space – Perching ducks and whistling ducks spend a considerable portion of their time in the trees. Having access to higher perching will provide them a safe refuge from larger waterfowl that may dominate the exhibit floor. At the Salisbury Zoo, for instance, I have observed wood ducks, generally the least-dominant waterfowl in our North American waterfowl exhibits, taking refuge in branches above the heads of larger, more dominant species, such as American black ducks.

Visual Barriers – provide visual barriers, both on land and in the water. This will allow birds to get out of sight of one another and avoid aggressive encounters. For new aviaries, consider the shape of both the aviary and the pool carefully. A large, open pool can easily be dominated by an aggressive pair of birds. A pool that has small islands in it, or curves

around rocks or deadfall, in effect becomes separate pools. Shier birds may be able to get out of sight of more assertive exhibit mates. Similarly, an aviary that is built in a non-linear manner, full of curves and alcoves, will allow for more visual separation than a long, thin aviary where birds can see each other from clear across the exhibit.

Multiple Resources - Feeders, nest boxes, water sources - many of the birds in your aviary will want the same things. If a dominant species has laid claim to a particular resource, such as a feeder, it may exclude less-dominant species from utilizing it. Having multiple feeders, nest boxes, etc. spread across the aviary will make it challenging for a dominant pair of birds to monopolize a resource to the exclusion of other birds.

Highlight Differences – Birds are most likely to be aggressive towards species that they view as competitors for resources. One method of reducing potential competition is to house species together that will utilize the exhibit and its resources differently. Andean geese are a species famed for their aggression; they are also very terrestrial. Exhibiting them with the highly aquatic black-necked swan will result in one species using the land areas but seldom the water, and one that is constantly in the water, but seldom on the land.

Form a Crowd – It may seem counter-intuitive, but sometimes filling an aviary with waterfowl

can reduce, rather than enhance, aggression. Going back to my program species, I've noticed that spotted whistling ducks have done well in aviaries that are filled with other birds; the only case of bullying that I've had to address since taking over as program leader has been in an aviary with only two other waterfowl species. When a "bully" species is housed with a single other pair of birds, it has only one other potential target for harassment. If it is housed with a dozen others, however, the effect is spread out, and it is less likely that a single bird will be picked on excessively.

As a final note, it's worth pointing that much of what we identify as "aggression" could better be described as "assertiveness." Birds in our care aren't (usually) looking to pick fights for the fun of it. They just want their needs to be met, whether that's access to a feeder or the best nesting spot in your aviary, and they are willing to use force to fulfill them. If those needs are satisfied and competition – real or perceived – is reduced, many waterfowl species will be capable of perfectly peaceful coexistence. 🌿



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One Does Not Simply Walk Into....a Crate: Crate Training a Hooded Merganser

Ashley Arimborgo, Registrar
Cheyenne Mountain Zoo
Colorado Springs, CO

Training a waterfowl that had never walked into a crate in his eight years at our zoo started off as a challenge. The exhibit set was such that I would not be able to safely train him to walk into the crate on land (the pond he lived on is in our moose exhibit, and shifting our moose off exhibit each time I wanted to train was not an option). Knowing that I would be sitting poolside against a rocky ledge that I didn't want him jumping up onto, my first thought was to use his natural tendency to both of our advantages.



Hooded Mergansers (*Lophodytes cucullatus*) spend most of their time in the water. As diving ducks it is where they are most comfortable. They will walk around and nest or roost on ground, but prefer the ponds and lakes to soil and grass. Bodo was no exception to this. Crate training had been attempted before using a traditional sky kennel approach on land. His previous "lady friend" would walk into the crate, and he would follow her a little but never seemed confident enough to go in on his own. Cheyenne Mountain Zoo is located at 6,714 feet above sea level and on the side of a mountain, so while he was perfectly capable of staying on his pond year-round, there were rare cases in the coldest of winters when we needed to break up the ice on the pond, and we did need to dump it to clean once every few years. Because of this we wanted to make sure that the ducks were safe and not in the way so it was required to move them to another enclosure for a few days. With a duck that won't crate, a net will get the job done but we like to challenge ourselves to always think of the best for the animals. With this goal in mind, we hoped to crate train Bodo and make catch-up's go smoothly and stress-free.

We had several top loading kennels that had many spaces in the crate to allow for water to flow out easily so we started a training plan with Bodo so he could swim into a crate as opposed to walking into one on land. At the time we had no additional merganser living on the pond with him but we did have some native mallard ducks that would visit and sometimes harass him for the floating duck pellets he was fed daily. We decided to start simply and just worked on building a relationship between Bodo and myself. Having not been his keeper, he did not have any reason to trust me. I took over his daily feedings and opted to break up his diet into an AM and a PM diet, allowing us to spend two 15-minute sessions together each day. During this time I also assessed where the best location to crate train would be and kept an eye on how the mallards would react to these training sessions. In addition to floating

waterfowl chow Bodo also received mealworms or super worms for his diet. My first goal was to get him comfortable enough with me to eat from me directly.

Within one week Bodo was eating super worms out of my hand and became more and more comfortable with my presence. I always had the crate with me so it was a familiar and unthreatening part of our sessions. After he began to calmly stay near me, I introduced the crate to the pond. I decided that using some of the pond plants to secure the crate in the open position while floating would allow him to become accustomed to the crate's presence, and created less of a disturbance at each training session. I began tossing worms and chow into the crate to build his confidence with swimming over it, and within two training sessions he would float above the crate with little to no hesitation while he ate. The only time we had shorter crate experiences were when the mallards in the pond began aggressing Bodo.

The mallard female began presenting a problem early on. To keep track of how the sessions were going I created a training template in ZIMS to document the food offered, length of the session, the mallards' behavior (if present), and how comfortable Bodo was acting. Each entry took minutes to complete and has been handy to review trends, patterns, and his progression with training. I often tossed chow as far across the pool as possible to keep the mallards busy. On days when the mallards were particularly prevalent, I started stationing the wild mallards on floating islands by tossing the chow directly onto them for the ducks to eat.

When Bodo's comfort level with the crate was at a premium, he would float over it and stay there through our session. As I continued to sit near him, I started fading out the bribe of leading him to the crate with a worm and used my finger to cue him into the crate, reinforcing him once he swam over the edge. As our sessions continued over the next week, his confidence continued to build. I was soon able to introduce a second person standing next to me, to offer them a cool opportunity to see Bodo up close and to help acclimate him to multiple people. I never knew on the day of a catch-up who was going to be there or what sort of activity was going to be around, and I wanted a desensitized bird with a solid crate behavior. He began to prefer to sit above the floating crate when I was around and it wasn't long before I felt confident that he would follow the crate and me anywhere around the pool edge. I decided to move the crate to a section of the pond that had recently been cleared of the water hyacinth (if anyone has worked near or around it you'll understand how quickly it



Training Tales...



We want to hear your Training Tales: the good, the bad and the fabulous!

Did you enjoy the latest Training Tale? Was this information useful or inspiring? Do you have any operant conditioning experiences that others would benefit from reading? Please submit your "Training Tales" and experiences in operant conditioning to share with *Animal Keepers' Forum* readers. This opportunity provides a convenient outlet for you to exhibit your training challenges, methods and milestones with the AAZK member network. Please submit entries based on the following guidelines:

- a. Submit a brief description of a training project at your facility. These can be 500 words or less, in text or bullet points – it can be longer (up to 1000 words); however, short and simple descriptions with a few images are just as perfect. Details should include the following:
 1. Define the training goal (what did you try to do and for what purpose?)
 2. List important steps (How did you do it – include plans that changed along the way/what worked and what didn't work)
 3. Timeline used (how long did it take)
 4. Tips you learned along the way
- b. Include 3-5 digital photos that clearly depict the animal in the learning process or performing the desired goal (provide photo caption and photographer of each image). Photos need to be 300 dpi and at least 1200 x 1800 pixels.

Please send submissions or questions to:

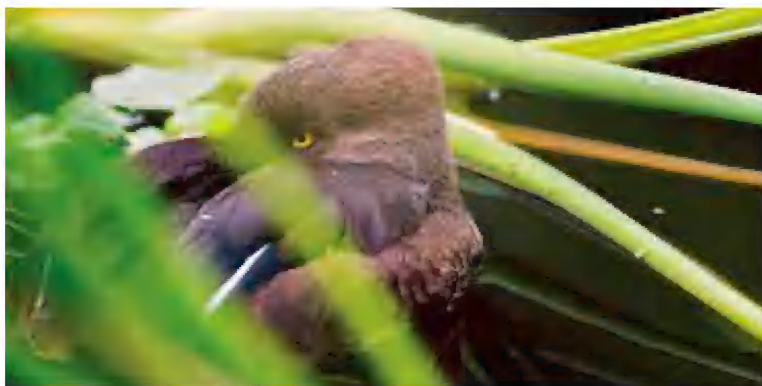
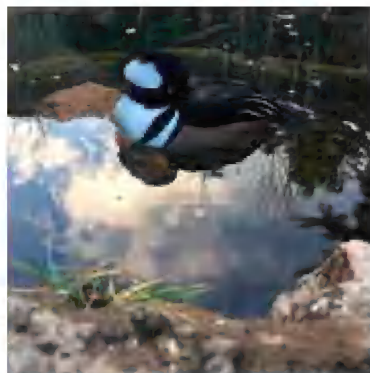
Kim Kezer at kkezer@zooneuengland.com
or

Shane Good at shane.good@aazk.org
(use Training Tales Submission
as the subject).

can become a vast blanket on the water!). This particular section of the pond had a small ledge under the water that I could rest the crate on, enabling me to close it with ease and less fumbling.

Moving the crate made no difference to him, he swam right in the first session. After that he would race me to the crate and wait for me, often resting above it after our training session was out of reinforcers. Ever since the beginning of our training and relationship, I would spend time hanging out with Bodo. Luckily, I had the time to spend with him. If I had only had one training tip, it would be to build a relationship as much as possible with the animal, even before starting to train. In the end, I had an animal that was well acclimated and comfortable around me to be relaxed no matter what. Because of this, I was able to pick up on a subtle change in his breathing that he disguised from anyone else who tried to listen to him. After all of the crate training sessions we had, I was able to successfully crate Bodo for a trip to the veterinarian for a physical exam. He was comfortable enough in the crate to snack on some worms and, overall, did very well with the process of being in a crate.

Photos by the author. 



Training Tales Editorial

By Angela Binney,

Training Tales Column Coordinator

This Training Tale by Ashley Arimborgo, at Cheyenne Mountain Zoo, is a great example of creative problem solving. The author describes how she pondered all of the potential limiting factors to successful crate training waterfowl, addressing each with thoughtful consideration. Using the animal's natural and individual history, she was able to create a training plan that worked brilliantly for the merganser. Investing the time to establish trust by just spending time with the animal was also key to her success. Zoo keepers don't always have flexibility in their day for quality down time with their animals; however, routine training sessions paired with a few extra minutes as time allows can have a huge impact on the comfort level the animal shows in general.

Having spent a few afternoons rounding up diving ducks out of ponds for various reasons, I can attest to the value of this training initiative. Perhaps some ducks are easier to catch than others, but one of the wildest goose chase type events (pun intended) in my zoo keeping career was the day my team was tasked with rounding up the diving ducks out of a 1-acre pond via net and row boat. Let's just say, there were more than ducks diving in the pond that day, either voluntarily in a valiant effort or by falling out of the boat trying to net a smart duck who knew exactly when to dive down to avoid a net. Granted it was not a Colorado winter, but I remember it was cold and we were in uniform and it was a bit chaotic to say the least. If we had the foresight to implement a crate training plan for those ducks, we could have saved a lot of stress for ducks and awkward fumbling for the keepers! No matter the size or disposition of an animal, having a plan for voluntary recall into a holding structure (barn, stall, crate, trailer, etc.) is a great addition to any husbandry protocol.

Elevating Husbandry of Call Ducks Through Training

Maggie Sipe, Zoo Keeper
Fort Wayne Children's Zoo
Fort Wayne, IN



Photo by Maggie Sipe

Abstract:

The Fort Wayne Children's Zoo received three one-year-old male call ducks (*Anas platyrhynchos domestica*) in the spring of 2014. They were fearful of keepers, which often made simple husbandry tasks like enriching, shifting, and weighing negative experiences for them. Positive relationship building began immediately, and a training program was started by October 2014. By November 2014, the ducks had all learned their first behavior of color discrimination targeting. More importantly, they began to trust their keepers. Since then, they have also learned color discrimination stations, and keepers are able to obtain voluntary weights. The keepers have witnessed vast improvements of cooperation by the call ducks in their husbandry procedures, which serves as a great reminder that training is beneficial to animals of any size or taxa.

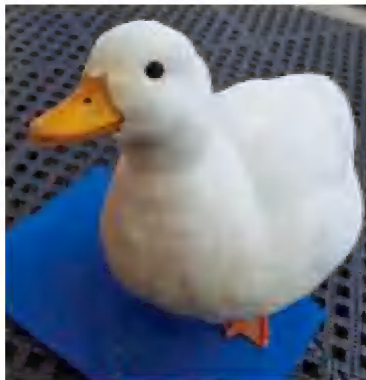
Introduction:

Three call duck clutch mates, named Sheldon, Howard and Leonard, arrived at the zoo in April 2014. They were wary of keepers and unsure of their new environment. They would show mostly fearful responses in keepers' presence making it difficult to observe many natural behaviors. Shifting ducks from one area to another involved herding them to the desired area with an aversive stimulus. Weights and exams could only be done by catching them up and weighing each duck in a box. Weights were never consistent because of the ducks' restlessness. The ducks became even more fearful of their keepers and their environment. Even introducing new enrichment items into their space often resulted in fear and avoidance behaviors making it difficult to accurately assess the success of the enrichment. A need for training was established and positive relationship building began immediately.

Before training could begin, it was necessary to get the ducks more comfortable with the keepers and to get them to accept food from keepers. For months, all keepers who worked in the area would spend as much time as they could with the ducks to desensitize them to the keepers' presence. It was discovered that the ducks were most comfortable in their pool and feeding them there led to more positive interactions. Keepers worked in small approximations getting closer to the pool as the ducks would eat. Keepers were then able to put their hands in the water under the food while the ducks would eat the food off of the surface. From there, keepers slowly approximated raising their hands higher until the ducks would just be eating from their hands. In a few short months, they readily accepted food from the keepers' hands and would anticipate



Three ducks on station. Photo by Stephanie Raimen.



Leonard on station. Photo by Stephanie Raimen.



Target sticks. Photo by Maggie Sipe.

the arrival of keepers by exiting the pool to approach them. Now that reinforcement could be delivered, the call duck training program began on October 14th.

Methods:

Training three individuals at once proved to be a challenge. Initially, one duck would be separated from his clutch mates in hopes of having a solo training session. However, this proved to be extremely stressful to the individual, as he would pace by the shift door and ignore all attempts of engaging with the trainer. It was concluded that all three individuals would have to be trained together. Targeting was the first behavioral goal for the ducks. The trainers believed it would be the most useful tool as a base for training.

Sheldon was the most dominant and food-motivated individual at the time so training began with him. The targets were constructed with paint stir sticks from a local hardware store, painted yellow, blue, or red on the paddle end. Sheldon was presented with the yellow target stick first. Through his natural curiosity, he pecked at it and caught on quickly that pecking the yellow stick led to a reward. The other two individuals were not as confident at the time, so they hung back and observed. Once Sheldon was reliably targeting to the yellow target, the other two colored targets were introduced. Initially, Sheldon targeted to any colored stick. The trainer believed this duck would learn that pecking the red or blue targets would not lead to a reward. However, Sheldon continued to target to other colors regardless of their lack of reinforcement history. Therefore, a new approach was taken. The new goal was to teach him that ignoring the red and blue targets led to a reward. The trainer presented the red or blue target then bridged and reinforced before Sheldon had a chance to peck it. At first, bridging and reinforcing occurred almost simultaneously upon target presentation. The trainer then increased duration between presenting the targets and reinforcing. This led to Sheldon ignoring the other targets and focusing only on the yellow one. This helped tremendously when moving on to the other two call ducks.

Howard proved the second-most eager to participate, so he was trained next. Sheldon remained indifferent to a second participant, as long as he received target training in the same session. In essence, the trainer was rewarding Sheldon for allowing other individuals to participate. The process was repeated with Howard using the red target stick. Having already trained color discrimination with Sheldon, the trainer applied previously learned lessons. When Howard was introduced to the other targets, the trainer immediately reinforced for no reaction to yellow or blue.

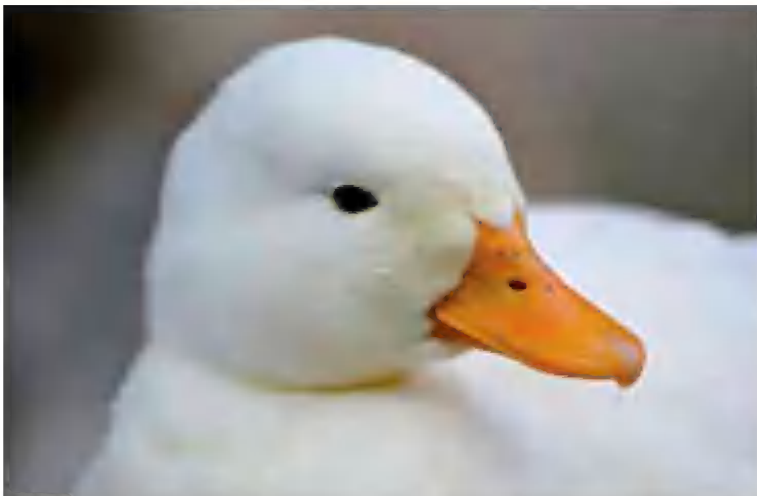


Photo by Stephanie Raimen

This made the process much smoother for this individual.

Leonard was the least dominant individual and often displaced from food by his clutch mates. To build Leonard's confidence, the other two individuals were targeted out of the pool and heavily reinforced on the ground so that Leonard could train in the pool. All three individuals could still see and reach each other very easily, eliminating the stress of being separated by a shift door. Leonard was presented with the blue stick and quickly caught on that pecking it led to a reward. By the time Leonard was ready to learn color discrimination, the other two no longer had to be separated out of the pool. It then became apparent that no training had to be done for this step as Leonard already avoided the other two targets. The added stimulus of the other ducks always displacing him when he reached for their color decreased his motivation to even get near the other targets. So he reliably only targeted to his blue stick.

The targeting behavior was also easily established outside of the pool and transferred to their winter holding area with some regression. The targeting behavior was under stimulus control for all three call ducks by November 2014.

While the ducks completed the targeting behavior, scale training became the next goal. The criteria for the scale behavior involved the ducks being targeted onto the scale and waiting until targeted off, once a weight was obtained. Scale training began in November, and the behavior was completed in just a few short weeks. It was considered to be under stimulus control by December.

Targeting became such a strong and well established behavior that every time the trainer would enter the duck enclosure, the ducks would excitedly crowd around the trainer and run around displacing each other for opportunities to train, even fighting occasionally. This was the basis for the decision to train a stationing behavior next because stationing would be incompatible with running around and fighting. The criteria for the finished behavior would involve each duck calmly standing with both feet on their station mat. The station mats were color specific which matched to each individual's target color. This mat could be moved throughout a session and the duck would follow. Station mats were constructed of colored pieces of craft foam cut in half.

When station training began, the color discrimination from targeting had transferred to the station mats easily. However, upon first presentation all three ducks attempted to pick up the mat and bring it to the trainer. To prevent this, station mats were then introduced only one at a time. Again, starting with Sheldon, he would be reinforced any time part of his foot would come into contact with the mat. In small approximations, criteria were raised to the point where both feet had to be on the mat to receive reinforcement. The same process was followed for the other two individuals.

Initially, a high rate of reinforcement was implemented to increase duration. However, the second they were not receiving reinforcement they would run off of the mats and would have to be re-cued onto station. While the stations were successful in keeping the ducks in a relative location, they would not stay on station for any length of time. A change in approach

for station training was adapted from our sea lion training team and solved the issue. The sea lions at our facility are only reinforced once they have returned to station after completing a desired behavior and are calm for the acceptance of reinforcement. When applied to the ducks, they would be targeted to a different area, but reinforcement was only given once they were back calmly waiting on their station. Within a month of the application of this method, the behavior was considered under stimulus control.

Other setbacks were encountered when the ducks were moved from winter holding to their exhibit. There was more space for them to get distracted on exhibit and the behavior had to be almost started from scratch in the spring of 2015. The trainer remained patient and the learning curve to retrain the behavior was much quicker.

Results:

The call ducks are vastly more comfortable in keepers' presence now. Catching them up for exams involves little to no chasing a majority of the time as the ducks have developed such strong relationships with the trainer. The ducks are no longer fearful of novel enrichment items presented by the keepers and readily investigate novel things. Keepers are able to observe their behaviors more easily and are able to determine the effectiveness of the enrichment towards eliciting natural behaviors. The ducks readily come out of their pool at night and shift into their indoor holding without the need of aversive techniques. Monthly weights are recorded with no stress to the ducks at all.

Conclusion:

The lives of these three individual ducks have improved greatly since the initiation of their training program. The first huge advantage has been their comfort level with keepers. Keepers can now interact with the ducks and hand-feed them. This makes it easier if there ever is a need for catching one up because there is minimal amount of chasing. Giving the animals the choice to participate in their care has proved beneficial in improving the welfare for these individuals. So often it is seen as unnecessary to train a smaller animal because it is so easy to handle them to get the information you need. Even training such simple behaviors can lead to huge improvements. Training these three small ducks has supported the idea that every animal, no matter how big or how small, deserves a chance to have the choice and control in their environment. 🐥

Waterfowl Husbandry and Propagation Chart **Ian Gereg**

Breeding and rearing:

- 1: Basic
- 2: Challenging
- 3: Difficult

Availability in aviculture (zoos and private aviculture):

- 1: Readily available
- 2: Occasionally available
- 3: Rarely available

Recommended diet:

- 1: Commercial waterfowl diet (Mazuri®, Purina®, etc.)
- 2: Dry dog kibble (small pellet)
- 3: Commercial sea duck diet (Mazuri®)
- 4: Grains and seeds (millet, wheat, etc.)
- 5: Greens (grass, lettuce, etc.)
- 6: Krill, fish, bloodworms, etc.

Compatibility (in a mixed-species waterfowl exhibit):

1. Compatible as breeding pairs in many mixed-species scenarios
2. Likely only compatible as breeding pairs with waterfowl outside tribe
3. Not likely to be compatible with other waterfowl (keep separate)

Nest site preferences:

- 1: Dense natural cover (grasses, sedges, etc.)
- 2: Sparse natural cover (rocks, shallow depression, etc.)
- 3: Nest box on the ground
- 4: Buried nest box with tunnel entrance
- 5: A-frame, three sided nest box, stick wigwam, etc.
- 6: Floating raft of heavy vegetation
- 7: Large vegetation pile (sticks, reeds, straw, etc.)
8. Elevated nest box

Editor's Note: An original version of these charts were originally published in American Pheasant and Waterfowl Society Magazine, Issue 1, January-February 2016. Pages 27-29.

Swans	Breeding	Rearing	Availability	Nest Site Pref.	Compat.	Egg Color	Clutch Size	Diet
Black	1	1	1	7	2	pale green to dull greenish white	4-6	1,4, 5
Black-necked	2	2	2	7	2	glossy cream	4-6	1,4,5
Coscoroba	2	1	2	7	2	white	5-9	1,4, 5
Mute	1	1	1	7	2	pale green	5-9	1,4, 5
Trumpeter	1	1	2	7	2	creamy white to dull white	4-6	1,4, 5
Tundra (Whistling, Bewick's)	3	1	3	7	2	creamy white	3-5	1,4, 5
Whooper	1	1	2	7	2	creamy white	4-6	1,4, 5
Whistling-ducks and allies	Breeding	Rearing	Availability	Nest Site Pref.	Compat.	Egg Color	Clutch Size	Diet
Black-bellied (Red-billed)	1	1	1	1,8	2	white to creamy white	10-14	1,4,5
Cuban (Black-billed)	1	1	2	1,3,8	2	cream	6-10	1,4,5
Fulvous	1	1	1	1,3	1	white to buff white	6-16	1,4,5
Javan (Lesser)	2	1	2	1,8	1	ivory white	7-17	1,4,5
Plumed (Eyton's)	2	1	2	1,3,8	1	milky white with cream tinge	6-10	1,4,5
Spotted	2	1	2	1,8	1	white	10-12	1,4,5
Wandering	2	1	2	1,3	1	creamy white	6-12	1,4,5
White-backed Duck	3	2	3	1,6	1	milk chocolate brown	4-10	1,4,5
White-faced	1	1	1	1,3	1	creamy white with pink tinge	6-8	1,4,5
Northern Geese	Breeding	Rearing	Availability	Nest Site Pref.	Compat.	Egg Color	Clutch Size	Diet
Bar-headed	1	1	1	2,5	1	white	4-6	1,4,5
Barnacle	1	1	1	2,5	1	white	4-6	1,4,5
Brant (all races)	3	1	3	2	1	creamy white with greenish tinge	3-5	1,4,5
Cackling (all races)	1	1	1	2,5	1	creamy white	3-6	1,4,5
Canada (all races)	1	1	1	2,5,7	2	creamy white	4-6	1,4,5
Emperor	1	1	1	2,5	1	creamy white	4-6	1,4,5
Greater White-fronted (all races)	1	1	2	2,5	1	white to creamy white	4-6	1,4,5
Graylag	1	1	2	2,5,7	2	creamy white	4-6	1,4,5
Hawaiian (Nene)	1	1	1	2,5	1	white to creamy white	4-6	1,4,5
Lesser White-fronted	1	1	2	2,5	1	white to creamy white	4-6	1,4,5
Pink-footed	1	1	2	2,5	1	white	4-6	1,4,5
Red-breasted	3	1	2	2,5	1	creamy white with greenish tinge	4-8	1,4,5
Ross'	1	1	2	2,5	1	white to pinkish white	3-5	1,4,5
Snow Goose (Lesser and Greater)	1	1	1	2,5	1	white	4-6	1,4,5
Swan	1	1	2	2,5	1	white	4-6	1,4,5



Cereopsis Goose with goslings

Sheldgeese	Breeding	Rearing	Availability	Nest Site Pref.	Compat.	Egg Color	Clutch Size	Diet
Andean	2	1	2	3,5	3	off white	6-8	1,4,5
Ashy-headed	2	1	3	3,5	3	light brown	4-6	1,4,5
Blue-winged	2	1	2	3,5	3	cream	4-9	1,4,5
Egyptian	1	1	1	2,3,4,5, 8	3	white to creamy white	5-10	1,4,5
Magellan (Lesser and Greater)	2	1	2	3,5	3	light brown	4-8	1,4,5
Orinoco	2	1	2	1,4,8	3	pale brownish cream	6-10	1,4,5
Ruddy-headed	2	1	2	3,5	3	light brown	4-6	1,4,5
Aberrant Waterfowl	Breeding	Rearing	Availability	Nest Site Pref.		Egg Color	Clutch Size	Diet
Cereopsis	1	1	2	2,5	3	creamy white	4-6	1,4,5
Freckled Duck	2	1	3	1,3,7	1	creamy white	5-7	1,4,5
Magpie Goose	2	1	2	7	1	cream to yellowish white	7-9	1,4,5
Pink-eared Duck	2	3	3	1,8	1	creamy white	6-8	1,3,6
Shelducks and allies	Breeding	Rearing	Availability	Nest Site Pref.	Compat.	Egg Color	Clutch Size	Diet
Australian	2	1	2	3,4,8	3	creamy white	6-12	1,4,5
Bronze-winged Duck	2	1	3	1,3,5	3	cream	4-6	1,4,5
Cape	1	1	2	3,4	3	creamy white	6-12	1,4,5
Common (European)	1	1	1	3,4	2	creamy white	6-12	1,4,5
Crested Duck (Andean and Patagonian)	2	1	3	1,3	3	cream	5-8	1,4,5
Paradise (New Zealand)	2	1	2	3,4	3	creamy white	6-12	1,4,5
Radjah	2	1	2	3,8	2	creamy white	6-10	1,4,5
Ruddy	1	1	1	3,4	3	creamy white	6-12	1,4,5
Perching Ducks and allies	Breeding	Rearing	Availability	Nest Site Pref.		Egg Color	Clutch Size	Diet
African Pygmy Goose	2	2	3	8	1	creamy white	6-10	1,4,5
Australian Wood Duck (Maned Goose)	1	1	1	3,8	1	white to creamy white	8-12	1,4,5
Comb Duck (Old World & New World)	2	1	3	3,8	2	Glossy white to yellowish	6-10	1,4,5
Green Pygmy Goose	2	2	3	8	1	creamy white	6-10	1,4,5
Hartlaub's Duck	2	1	3	3,8	3	creamy white	7-10	1,4,5
Indian Pygmy Goose	2	2	3	8	1	creamy white	6-9	1,4,5
Mandarin Duck	1	1	1	8	1	white to buff	8-14	1,4,5
Muscovy Duck (wild)	1	1	3	8	2	white	8-10	1,4,5
North American Wood Duck	1	1	1	8	1	white	10-14	1,4,5
Spur-winged Goose (White and Black)	2	1	3	1,3, 5	3	ivory to pale brown	8-10	1,4,5
White-winged Wood Duck	2	1	3	8	2	white with greenish tinge	6-12	1,4,5

Dabbling Ducks	Breeding	Rearing	Availability	Nest Site Pref.	Compat.	Egg Color	Clutch Size	Diet
African Black Duck	2	1	3	1,3	2	pale yellow	4-8	1,4,5
American Black Duck	1	1	1	1,3	1	cream to pale buffish green	7-12	1,4,5
American Wigeon	1	1	1	1,3	1	creamy white	7-10	1,4,5
Australasian Shoveler (Aust. & N.Z. races)	2	1	2	1,3	1	creamy white with greenish tinge	9-11	1,4,5
Bahama (White-cheeked) Pintail	1	1	1	1,3	1	buff	6-10	1,4,5
Baikal Teal	2	1	2	1,3	1	pale greyish green	4-10	1,4,5
Blue-winged Teal	1	1	1	1,3	1	creamy tan	7-11	1,4,5
Brazilian Teal	1	1	1	1,3, 8	1	creamy white	6-8	1,4,5
Cape Teal	1	1	1	1,3	1	cream	5-11	1,4,5
Chestnut Teal	1	1	1	1,3,8	1	light cream	7-10	1,4,5
Chiloe Wigeon	1	1	1	1,3	1	ivory	5-9	1,4,5
Cinnamon Teal (all races)	1	1	1	1,3	1	creamy white to pale buff	9-12	1,4,5
Common (Euro. Green-winged) Teal	1	1	2	1,3	1	creamy white	8-12	1,4,5
Eurasian Wigeon	1	1	1	1,3	1	cream to pale buff	8-10	1,4,5
Falcated Duck	1	1	1	1,3	1	white with pinkish yellow tinge	6-10	1,4,5
Gadwall	1	1	1	1,3	1	creamy white with pinkish tinge	8-12	1,4,5
Garganey	1	1	2	1,3	1	buff to light straw	6-14	1,4,5
Green-winged Teal (American)	1	1	1	1,3	1	creamy white	8-12	1,4,5
Grey Teal (all races)	1	1	2	1,3,8	1	cream to creamy white	8-10	1,4,5
Hawaiian Duck	1	1	2	1,3,8	2	white, buff or light tan	2-10	1,4,5
Hottentot Teal	1	1	2	1,3,8	1	cream to yellowish buff	6-9	1,4,5
Laysan Duck	1	1	2	1,3,8	2	ivory to light buff	3-6	1,4,5
Mallard	1	1	1	1-8	2	grey-green to bluish	9-13	1,4,5
Meller's Duck	1	1	3	1,3,8	2	dull white to pale olive	5-12	1,4,5
Mottled Duck	1	1	2	1,3	2	dull white to pale olive	5-14	1,4,5
Northern Pintail	1	1	1	1,3	1	Off white to yellowish green	6-12	1,4,5
Northern Shoveler	2	1	1	1,3	1	olive buff to pale green-grey	5-14	1,4,5
Pacific Black Duck	1	1	3	1,3	1	pale cream	7-12	1,4,5
Philippine Duck	1	1	2	1,3	1	brownish white	8-10	1,4,5
Puna Teal	1	1	2	3,8	1	creamy white to buffish	5-6	1,4,5
Red Shoveler	1	1	2	1,3	1	white with pinkish-yellow tinge	5-8	1,4,5
Red-billed Pintail	1	1	2	1,3	1	buff to creamy white	6-12	1,4,5
Ringed Teal	1	1	1	3,8	1	white	6-10	1,4,5
Silver (Versicolor) Teal	1	1	1	1,3	1	creamy white to buffish	6-10	1,4,5
South American Teal (Chilean & Sharp-winged)	1	1	2	1,3	1	creamy white	5-8	1,4,5
South Georgia Pintail	1	1	3	1,3	1	light buff	3-9	1,4,5
Spot-billed Duck (all races)	1	1	1	1,3	2	white to greyish white	8-10	1,4,5
Yellow-billed Duck	1	1	3	1,3	2	creamy yellow or buff	6-12	1,4,5
Yellow-billed Pintail	1	1	2	1,3	1	cream	6-12	1,4,5

Emperor goose flock. Photo by Ian Gereg.



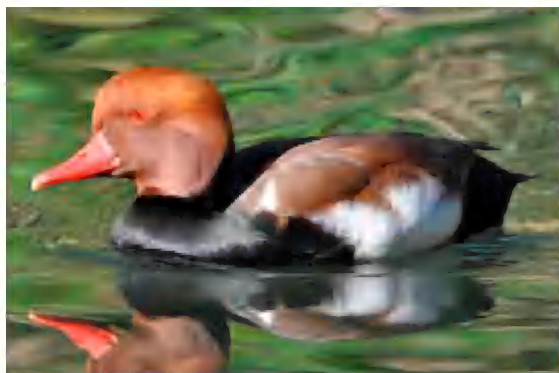
Ringed Teal male. Photo by Ian Gereg.



Pochards	Breeding	Rearing	Availability	Nest Site Pref.	Compat.	Egg Color	Clutch Size	Diet
Australian White-eye	2	1	3	1,3,5	1	creamy white	9-13	1,2,4,5
Baer's Pochard	2	1	3	1,3,5	1	creamy white to light buff	9-13	1,2,4,5
Canvasback	2	1	1	1,3,5	1	greyish olive	6-10	1,2,4,5
Common Pochard	2	1	3	1,3,5	1	green-grey	6-14	1,2,4,5
Ferruginous White-eye	2	1	2	1,3,5	1	creamy white to light buff	7-10	1,2,4,5
Greater Scaup	2	1	1	1,5	1	olive grey	7-14	1,2,4,5
Lesser Scaup	2	1	1	1,5	1	greenish buff	8-10	1,2,4,5
Marbled Duck	2	1	1	1,3,4,8	1	pale straw	10-15	1,4,5
New Zealand Scaup	2	1	3	1,3,5	1	creamy white to mocha brown	4-8	1,2,4,5
Red-crested Pochard	2	1	1	1,3,5, 8	1	pale greenish-grey	8-10	1,2,4,5
Redhead	2	1	1	1,3,5	1	creamy white to brownish buff	7-14	1,2,4,5
Ring-necked Duck	2	1	1	1,5	1	olive-buff	6-14	1,2,4,5
Rosybill	2	1	1	1,3,5	1	cream to greenish grey	8-10	1,2,4,5
Southern Pochard	2	1	3	1,3,5	1	creamy white to light brown	6-12	1,2,4,5
Tufted Duck	2	1	2	1,3,5	1	greenish grey	8-12	1,2,4,5



Bufflehead duck



Red-crested pochard male

Sea Ducks	Breeding	Rearing	Availability	Nest Site Pref.	Compat.	Egg Color	Clutch Size	Diet
Barrow's Goldeneye	2	2	2	3,8	2	bluish green	8-12	2,3,6
Bufflehead	2	3	2	8	2	light olive with bluish tinge	5-8	2,3,6
Chinese (Scaly-sided) Merganser	3	3	3	8	1	creamy white	7-12	2,3,6
Common Eider (all races)	2	3	3	1,2,3,5	1	green gray	4-6	2,3,6
Common Goldeneye	2	2	2	3,8	2	greenish	8-12	2,3,6
Common Merganser	3	3	3	8	2	creamy white	8-12	2,3,6
Harlequin Duck	3	3	3	3,5,8	1	creamy yellow	5-7	2,3,6
Hooded Merganser	2	2	1	8	1	grayish white	7-12	2,3,6
King Eider	3	3	3	2,5	1	olive to olive-buff	4-6	2,3,6
Long-tailed Duck (Oldsquaw)	3	3	3	2,5	1	greenish to olive buff	6-10	2,3,6
Red-breasted Merganser	3	3	3	2,3,5	1	olive buff	6-12	2,3,6
Smew	2	2	2	8	1	cream to pale buff	7-9	2,3,6
Spectacled Eider	2	3	3	2,5	1	olive to olive-buff	4-6	2,3,6
White-winged Scoter	3	3	3	2	1	creamy buff	6-9	2,3,6
Steamer Ducks	Breeding	Rearing	Availability	Nest Site Pref.		Egg Color	Clutch Size	Diet
Flying	3	2	3	1,3	3	white to buff	5-9	2,3,6
Magellanic	3	2	3	1,3	3	white to buff	4-8	2,3,6
Stiff-tails and allies	Breeding	Rearing	Availability	Nest Site Pref.		Egg Color	Clutch Size	Diet
Argentine Ruddy Duck	2	3	3	1,3,6	1	white	3-5	1,2,4,5
Black-headed Duck	3	3	3	parasitic	1	white	5-16	1,2,4,5
Maccoa Duck	2	3	3	1,3,6	2	white	4-6	1,2,4,5
North American Ruddy Duck	2	3	2	1,3,6	1	white	5-8	1,2,4,5
White-headed Duck	2	3	3	1,3,6	1	white	4-6	1,2,4,5

Small Zoo, Big Impact: Creating Partnerships and Leveraging Resources for White-winged Wood Duck Conservation

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Jim Metzinger, Director, J.H. Barrow Field Station, Hiram College
Joe Golgosky, Wild Animal Keeper III, Akron Zoological Park
Shane Good, Animal Curator, Akron Zoological Park

Let's face it, most of the time conservation costs money. Much of the time, big conservation costs big money. We can't all lead the charge to save elephants, giant pandas and rhinos – nor should we. Smaller species need big help as well, and that means there are opportunities out there for institutions and budgets of all sizes to be able to plant their conservation flags and to fly them high.

Some of the most successful and rewarding conservation programs in zoos are those that focus on species that can be held in small spaces and large groups. Almost all of the most successful conservation programs require collaboration. What's going on with the white-winged wood duck (*Asarcornis scutulata*) is no exception.

The white-winged wood duck is classified as endangered by the International Union for Conservation of Nature (IUCN). Native to India, Southeast Asia and Indonesia, it's one of the rarest species of waterfowl in the world. Their forested wetland habitat is under threat from deforestation, drainage for agriculture, hunting and egg collection. Populations are fragmented and studying these birds is difficult in the wild. They don't tend to form large flocks, and even though they are big ducks, they perch in the forest canopy and nest in cavities in large trees. The Akron Zoo, Wildlife Conservation Society (WCS), Sylvania Heights and International Wild Waterfowl Association (IWWA) all support field conservation work in countries such as Cambodia and India. In 2015 the IWWA sponsored a student through their Liz Hudson Memorial Grant, Murchana Parasar, from India who travelled to the United States to learn about the white-winged wood duck program in North America. She is from Assam, where the white-winged wood duck is native. It's actually the state bird! While in the US, Murchana spent time at Sylvania Heights in North Carolina, and visited us in Ohio to see the Akron Zoo and the Endangered Waterfowl Breeding Center at Hiram College (more on this later). In 2017 the Akron Zoo funded Murchana's masters project in

India. She is studying the distribution of white-winged wood ducks in and around Dehing Pakai Wildlife Sanctuary, which is the biggest living patch of rainforest of Northeast India. She is also undertaking a survey of the local population to find out their knowledge of and feelings about white-winged wood ducks (WWWD) before and after some outreach and education programs. In other exciting 2017 news, the WCS team observed the first active WWWD nest in their study area in the Northern Plains of Cambodia in five years. They were even able to obtain camera footage of the fledging ducklings.

Field conservation work and its eventual successes tend to take time. Sometimes when a wild population is in steep decline we run out of time, therefore an important part of a zoo's species conservation efforts focuses on sustainability of the captive population until re-introduction is feasible.

The current North American population of white-winged wood ducks was established by Mike and Ali Lubbock of Sylvania Heights Bird Park. Sylvania Heights actually owns all of the ducks and loans them to zoos and other organizations in an effort to establish and maintain a diverse captive population. They are also the holders of the largest number of WWWDs and have been the most successful breeders of them through the years.

One of the first big steps in the collaboration process happened when Sylvania Heights partnered with the Association of Zoos and Aquariums (AZA) Anseriformes Taxon Advisory Group (TAG) and formed a white-winged wood duck Species Survival Program (SSP). This meant more zoos were paying attention and giving priority to the species and the population and its lineage would be monitored more closely. The first SSP coordinator was Doug Piekarz, who is now the President and CEO of the Akron Zoo. Since Doug developed the studbook, the SSP program coordinator and studbook keeper roles have changed hands a couple



White-winged wood duck. Photo by Nick Hill

of times, but someone at the Akron Zoo has always been the champion for the species.

The white-winged wood duck SSP was developed and has always been managed at the Akron Zoo. This article is all about smaller zoos making a big conservation difference through collaborative work, so we can't stop the story there. Let's get on to perhaps the most unique part of the work we do. It begins with a unique problem. The white-winged wood duck population has a health problem. Specifically, the ducks are exquisitely sensitive to avian tuberculosis, or *Mycobacterium avium*. Only a few original pairs were brought into human care in the 1960's and 70's, and this has resulted in extremely low genetic diversity in the current population. This low genetic diversity is thought to be contributing to the disease susceptibility.

In order to do research on the husbandry and health of the WWWD population, we developed a unique local partnership. We needed a place to house a lot of ducks within very specific husbandry parameters. We needed a facility where the ducks would get plenty of UV which helps to eliminate *M. avium* from the environment; a place where there was no soil to water interface, mycobacterium's favorite place to grow; a facility that could be easily disinfected; and somewhere that was isolated from other ducks and wildlife so that we weren't combatting outside sources of disease. That is when the Endangered Waterfowl Breeding Center was born and built. It was developed as a partnership between the Akron Zoo and Hiram College, a local four-year college. Hiram College provides the location for the Center at their J. H. Barrow Field Station, and they also provide the daily care in the form of students who work at the field station. The field station director, Jim Metzinger, oversees the daily operation. The zoo provides the ducks, funds expenses such as food and cleaning supplies, and provides veterinary care as well. The students gain valuable animal care and handling experience, and are

given opportunities to develop their own non-invasive research projects involving the ducks and to participate in their veterinary care.

Through the years multiple avenues have been investigated regarding how best to care for white-winged wood ducks and what unique characteristics of the species may be making them so susceptible to disease. Jody Modarelli, a late biochemistry professor at Hiram College, worked with the Zoo and her students on several projects regarding WWWD immunoglobulins. They found that the ducks' immune system switched its major type of defense around the time of sexual maturity. Perhaps one type of defense was better than the other against mycobacterium? We used that information to see if head-starting birds in a very clean environment, until they'd gone through that immune change, would be the secret to keeping them healthy. Unfortunately, that wasn't the silver bullet we were hoping for. If they are put into an environment with mycobacterium, they can still develop disease once they are adults. However, we have determined that the Center is a great place to head start healthy birds from either egg or brooder table age in order to bolster the population numbers.

We are continuing to experiment with practical husbandry applications such as different methods of water filtration, different types of nest boxes, and even diets. We found evidence that an environmental parasite might be helping the mycobacterium to enter the cells of the ducks. By testing samples of water from different zoos and from the Endangered Waterfowl Breeding Center we determined that the parasites in question are not present in the center but they are in several zoos. Further work needs to be done in this area to find out whether or not the parasites are indeed a factor in disease development. 🐼

Then and Now: Waterfowl in Captivity

Dustin Foote, M.S.
Assistant Curator and Research Coordinator
PhD Student, East Carolina University
Sylvan Heights Bird Park

Anseriformes, commonly known as the waterfowl, span the globe in distribution making them arguably one of the most recognized birds by the general public. The continental United States does an excellent job at protecting habitat for its migrational waterfowl, with the Federal Duck Stamp Program and organizations such as Ducks Unlimited protecting over 10 million acres of wetland habitat in North America. Between the Mallard and the Canada Goose, most visitors can quickly recognize a member of the waterfowl family, making them ideal species to connect with visitors. Large collections of waterfowl were once plentiful in the United States but have drastically declined within the last 30 years.

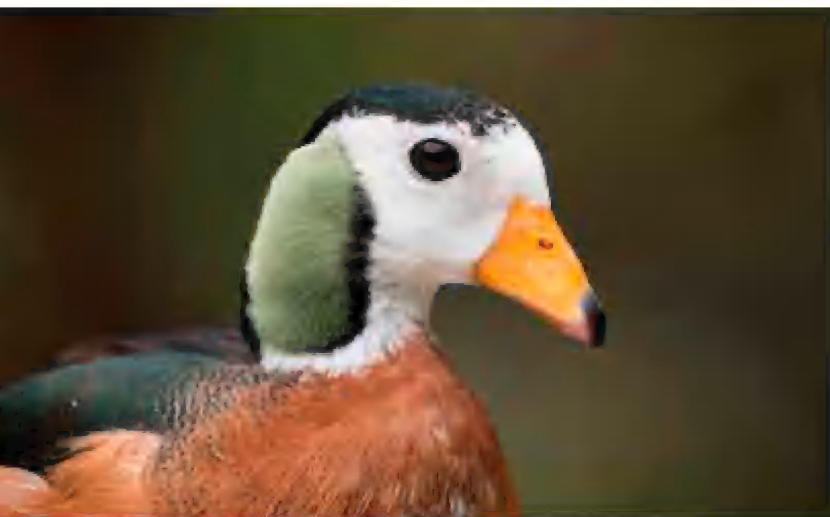
Zoological facilities exist to educate the public and help conserve biodiversity around the globe, but at the end of the day they are still subject to the same demands of any business (most facilities anyway). The popular term, “edutainment” is fitting, as zoos are

being held to these education/conservation expectations, but ultimately must provide patrons enough entertainment to insure a financially sustainable business. Admission, membership, and donations are all critical parts of the average zoo business model. Research has shown the general public wants to see the charismatic mega-fauna (lions, rhinos, bears, etc.); furthermore, they want to know that these animals are well cared for and have direct ties benefiting their wild counterparts. Consequently, bird collections are often relegated to extra exhibit space with extremely limited budgets, with avian collections waxing and waning with every new director/curator’s interests. Many of the preeminent waterfowl collections within American zoos can be attributed to one or two individuals who had an interest. However, while these individuals are ultimately responsible for the fate of the collection, the success of a collection rests on the shoulders of the husbandry staff. Curators, supervisors, or senior employees who have the ability to foster

passion in their staff are undoubtedly rewarded when staff members become invested in a collection.

On paper, waterfowl husbandry can be simple, especially compared to some of the complex diet and routines many avian species require. A good diet and clean water are the backbone of any successful waterfowl collection. Nevertheless, clean water can be extremely difficult and/or expensive depending on your source. Taking advantage of natural water features can mitigate this issue, however rarely is it feasible to enclose these areas. As a consequence, many zoo collections keep waterfowl on open ponds or adapt artificial water features in exhibits designed for non-waterfowl species. Indoor exhibits can also be difficult, as waterfowl demand good airflow and natural lighting to remain healthy. Historically, waterfowl collections consisted of pinioned birds kept on open ponds. However, public perception of pinioning and highly pathogenic avian influenza (HPAI) have drastically reduced the use of open ponds in American collections. With limited space and funding, many collections require practical approaches to housing waterfowl. Keeping a species’ ecology in mind, pinioning can provide a very practical solution to keeping larger waterfowl (swans, geese, screamers), on large ponds without the need for overhead netting. For many of these species, the ability to fly is not a major part of their daily activities, especially some of the more aquatic swans. However, pinioning begins to impact the health and reproductive success of many ducks when moving towards the smaller members of anatidae. For southern zoos, nylon netting can be a cost-effective application, allowing aviaries to be covered. However, predators and snow can often cause problems with this approach. When working on improving or installing waterfowl exhibits, it is important to think about the general ecology of each species.

Some of the most successful avian breeding programs arise from collections with the ability to quickly change breeding pairs/groups that



African Pygmy Goose. Photo by Katie Gipple Lubbock.

are not successful. Furthermore, individuals such as Arnold and Debbie Schouten, and Robert Kooij are some of the world's most successful waterfowl aviculturists because they are specialists. Their collections are focused on several species with multiple breeding pairs, allowing them success with rather difficult species. Toledo Zoo had an article in a past issue of AZA Connect on the management of the Pink-headed Fruit Dove program, also addressing this topic. Some species may benefit more if their numbers are concentrated in a few facilities with focused efforts compared to a broader distribution of the population. Ideally these facilities have the capacity to not only set up numerous pairs, but to house offspring for several years. Once these facilities build up their population, individuals can be sent out to other collections. Pygmy geese, Pink-eared Ducks, and steamer ducks are just some examples that could benefit from this approach. Collections should also play to their strengths, northern, southern, coastal, urban, rural all have diverse resources that benefit different species. Northern zoos would benefit species such as Eiders, Long-tails, and Red-breasted Geese, while southern zoos are able to keep tropical species outside all year. While keeping in mind the public's expectation of a diverse collection, waterfowl would benefit from a balance between diversity and focused efforts.

Domestic waterfowl serve an extremely useful purpose when used in a hands-on setting. "Roadside" petting zoos are in serious decline; with many accredited zoos also removing these areas to prevent zoonotic concerns or to dissociate with these "roadside" facilities. While these are valid apprehensions, domestic areas are often the most memorable part of a child's visit. In the eyes of many children, Pygmy geese, Chinese Mergansers, and Baer's Pochards pale in comparison to the Peking Duck (aka the Aflac duck) or a Domestic Turkey. Making use of these domestic breeds ultimately serves to connect the visitor with species in need, simply by starting the connection (people connect with what they recognize). It can be easy to overlook the usefulness of domestic waterfowl.

The partnership between private collections and the accredited zoological facility is unique, though understandably complicated. Zoos are facing unprecedented scrutiny from society, being forced to justify their overarching mission of conservation and education. Making clear distinctions between facilities is often necessary to help deflect unwanted attention, especially in the light of social media. However, there are numerous examples of non-accredited facilities with the resources and knowledge to be incredibly beneficial to accredited zoos. These partnerships must be carefully considered so practical solutions can

be reached that enhance each facilities's goal. For many taxa of birds, these partnerships can make the difference when attempting to conserve a species in captivity.

The Waterfowl Conservation Workshop was formed in 2016 by Sylvan Heights Bird Park (SHBP) and the International Wild Waterfowl Association (IWWA). The objectives

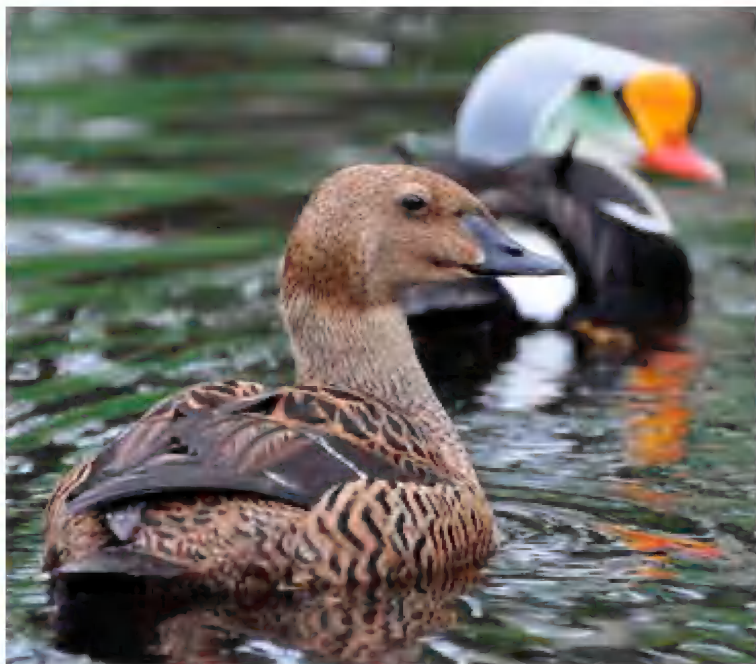
of this event were to establish a network of professionals dedicated to the future of waterfowl conservation, address current concerns across the industry, bridge gaps in communication among international organizations and communities, and provide a resource from which aviculturists can draw knowledge and information about waterfowl husbandry. The idea for this event arose from



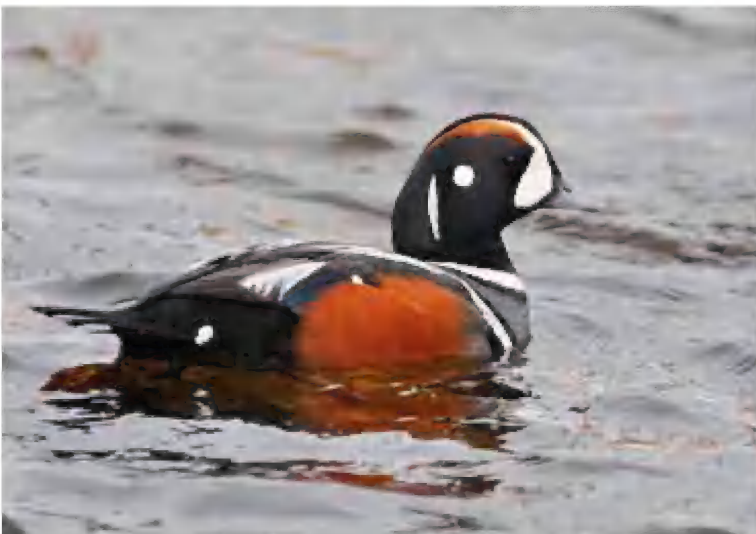
Spectacled Eider trio. Photo by Ian Gereg.



Common Merganser. Photo by Ian Gereg.



King Eider pair - female in front. Photo by Ian Gereg.



Harlequin male. Photo by Ian Gereg.

the need to include younger aviculture and conservation professionals in workshops and conventions, and bridge the gap between both older and younger generations, as well as public and private institutions. Attendees traveled from a variety of countries, including the Netherlands, England, Portugal, Brazil, Canada, and much of the United States. Many institutions were represented, including Sea World San Diego, Toledo Zoo, the Wildfowl

& Wetlands Trust, Alaska SeaLife Center, Pensthorpe Conservation Trust, Woodland Park Zoo, Pinola Conservancy, Livingston Ripley Waterfowl Conservancy, Zooparque Itatiba, National Aviary, Cleveland Metroparks Zoo, Oregon Zoo, Akron Zoo, USGS Patuxent Wildlife Research Center, Fort Worth Zoo, Minnesota Zoo, and many others. Both public and private avicultural institutions were well represented, and much of the discussion focused on

improved collaboration and communication between both sectors.

The next Waterfowl Conservation Workshop (WCW) will be on October 25th-27th, 2018 in Greenville, North Carolina. Based on feedback from 2016 participants, the 2018 WCW will consist of two days of presentations and discussion, and one day of practical, hands-on workshops at Sylvan Heights Bird Park. There are also optional post-workshop tours and activities. Information about registration can be found at <https://waterfowlconservation.org/>. Individuals interested in presenting can also submit requests through this website.

Defining a species can be difficult, and consequently determining what species are endangered, vulnerable, etc. can also be tricky. Furthermore, species can be increasingly rare in captivity while stable in the wild. When considering what species to work with, it is important to recognize the difference between endangered captive populations and wild populations. The International Union for the Conservation of Nature (IUCN) is one of the most commonly used sources for assigning a species population status. Often, species that fall just outside the endangered statuses are in more danger of disappearing in captivity. These species lack the public appeal of being labeled as endangered, yet are still in need of our attention. Sometimes referred to as "brown duck syndrome", dull species of waterfowl are in constant need of attention as their demand in public and private collections is very low. For species that are colorful and endangered such as Chinese Mergansers and White-headed Ducks, captive populations are in much better shape in captivity, compared to Indian Spot-billed Ducks, Laysan Teal, Common Pochards, and African Yellow-billed Ducks.

Conservation is a term that many of the general public do not fully understand. Education, cooperation, and communication are all critical components of any successful conservation project. As aviculturists, we are in the ideal position to educate the public, cooperate with each other, and communicate our experience to all parties involved. Birds are inherently difficult to conserve; how do we protect something that has no boundaries, crossing state and international lines? Challenging as this may be, it poses a unique opportunity of connecting people across the world. The best solutions to any problem is practical; otherwise they will fail. As we look to the future of captive waterfowl in the United States, continued communication between multiple groups will give rise to simple solutions. These solutions will benefit the health of waterfowl worldwide as we attempt to conserve species in both captivity and the wild. 🦆

Answering the Duck Call

Diana Ferrara, Keeper
San Diego Zoo
San Diego, California

As the sun begins to rise in the humid forest, a whistling bird call greets you. A rumble of thunder can be heard in the distance, and rain soon begins to fall as the bird song rises to a cacophony. It is easy to imagine being off in a remote location, far from civilization. But you are in Shreveport, Louisiana, in what is in reality someone's backyard. The only thing "uncivilized" about your stay is the lack of an Uber® in town.

This backyard is home to Pinola Conservancy and is the private residence of Paul Dickson. Curated by Jacob Kraemer, the 11-acre property has multiple aviaries housing nearly 1500 birds and 300 species ranging from waterfowl, songbirds, shorebirds, and cassowaries. Once just a hobby, Pinola now primarily focuses on breeding waterfowl for other institutions. The conservancy also takes part in numerous conservation efforts and supports studies conducted by universities and the U.S. Fish and Wildlife Department.

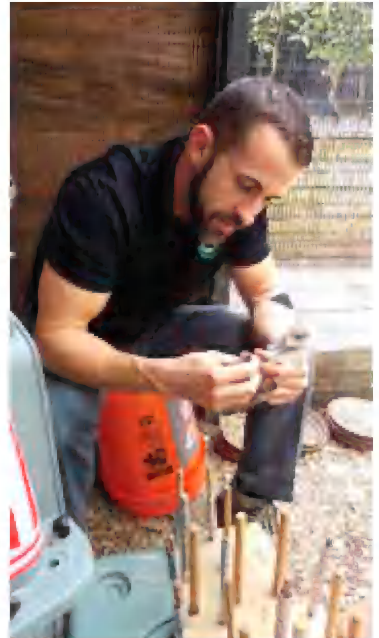
For further outreach, over the past three years Pinola has opened its doors for keepers to participate in week-long internships. Internships are offered during peak breeding season from March through May, and focus on hand-rearing waterfowl and other precocial species. Keepers can also arrange to go earlier in the year to learn how to prepare for the upcoming breeding season. Pinola hosts 10-15 interns per year, and the internships are tailored to meet each keeper's specific goals. Jacob personally acts as a mentor, making sure interns participate in the full hand-rearing

experience while achieving the goals that brought them to Pinola.

Each intern has an opportunity to strengthen husbandry skills, and with 800 chicks hatching each breeding season, they can learn on a wide variety of birds. From more common species like redheads, wood ducks, and cinnamon teal to more delicate species like pink-eared ducks and ruddy ducks, interns have exposure hand-raising species they might not normally have opportunities to work with at other facilities.

This breadth of experience is what encouraged me to pursue a Pinola internship. My first experience raising waterfowl was nine years ago at the Akron Zoo in Ohio. I immediately fell in love with the entire egg incubation and hand-rearing process. Even now, as my work focuses predominantly on more altricial species like passerines, I still have a soft spot for the fuzzy precocials I spent so much of my career raising. Now that I am a keeper at the San Diego Zoo's Avian Propagation Center, I wanted to refresh my waterfowl hand-rearing skills and bring new ideas and information to my team.

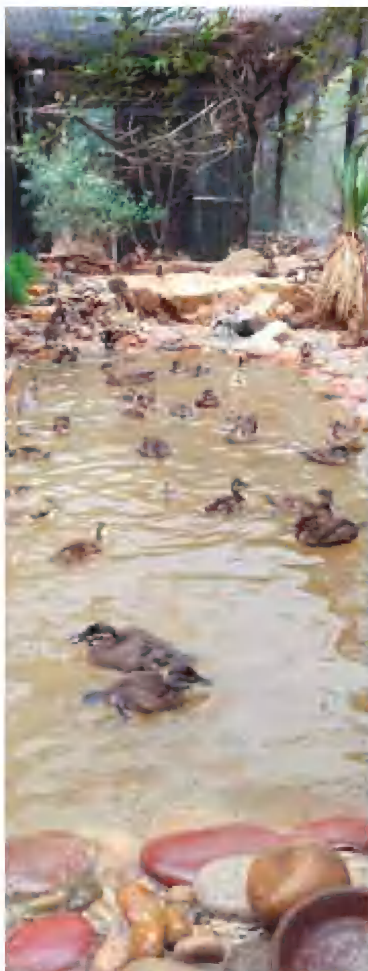
One of the things I was most struck by is how easy it is to forget you are steps away from residential homes while walking through Pinola's grounds. There is one large free-flight aviary, and several smaller aviaries housing species from across the globe. As I wanted to focus on strengthening my hand-rearing skills, Jacob led me to the brooder room. Taking my first steps into the room, I knew I was in the right place, and I was going to have a good week. The room holds three rows of wet brooders, special tubs used for hand-rearing precocial species. The twenty-four brooders



Jacob Kraemer places a permanent band on a juvenile Marbled Teal (*Marmaronetta angustirostris*).
Photo by Diana Ferrara



The outdoor brooder room. Photo by Diana Ferrara



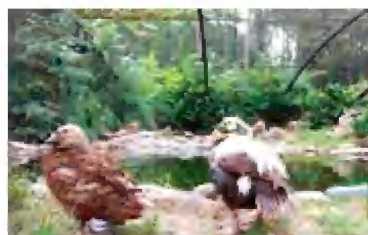
The juvenile pool reserved for ducks that outgrow the brooder room. Photo by Diana Ferrara.



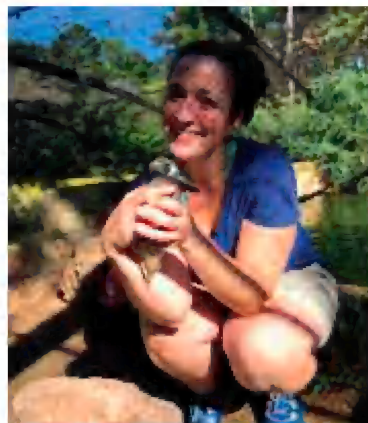
Jacob vent sexing a male duck. Photo by Diana Ferrara.



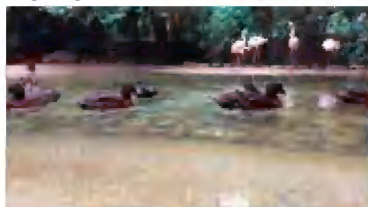
Vent sexing female. Photo by Diana Ferrara.



A pair of Spectacled Eiders (*Somateria fischeri*). Photo by Diana Ferrara.



A juvenile Pink-eared Duck (*Malacorhynchus membranaceus*) is released into an aviary after outgrowing the brooder room. Photo by Jacob Kraemer.



Hartlaub's Ducks (*Pteronetta hartlaubii*) and Lesser Flamingos (*Phoeniconaias minor*) in the Tropical Aviary. Photo by Diana Ferrara.

were filled to capacity with fuzzy ducklings, goslings, and shorebirds of various species.

My first two days focused largely on husbandry and learning chick identification. After checking for fresh hatches, I would transfer the newly dried chicks to dry brooders. Waterfowl hatch with downy feathers and it is important they dry completely in a hatcher before transferring to a brooder. After feeding the chicks, I would transfer the goslings to outdoor corrals so they could graze the day away. Then cleaning would commence, and for new hands like me, this took the majority of the day.

By the third day, I was able to focus on skills I knew I needed more practice with like vent sexing and pinioning. Waterfowl can be vent sexed at a few days old to determine if the

chick is male or female by applying pressure to their cloaca. After being able to vent sex a brooder full of ducklings successfully, I then practiced pinioning the chicks. Pinioning permanently removes a portion of the wing to prevent flight, a common practice for waterfowl that allows birds to live outdoors in unenclosed exhibits. I was able to practice my developing skills several times throughout the week, and I was appreciative of the patient tutelage and guidance shown by Jacob.

As my comfort level grew, I was able to help the staff in other areas. We rounded up and placed identification bands on the legs of juvenile ducklings and goslings that had already moved into larger pools outside of the brooder room. I helped check nestboxes throughout all the aviaries and collected eggs

to be set for artificial incubation. Since I have experience with incubation, I was able to offer my assistance setting eggs, candling - a process to check for viability by illuminating the egg using a candle - and doing general upkeep in the incubation room. I was even fortunate to see a southern cassowary egg candled, a first for me, and assist in feeding a newly hatched woodland kingfisher, also a first. The days flew by, and as the week came to an end I found myself sad to leave the animals and staff at Pinola.

The entire staff is hard-working, kind and welcoming. They were there to offer a helping hand, quick to fix anything that I managed to break, and eager to share their knowledge with me. Further, everyone was just as enthusiastic to ask questions and to learn about my past



Jacob goes to great lengths to check every nest for eggs. Photo by Diana Ferrara



A wet brooder full of White-winged Wood Ducks (*Asarcornis scutulata*). Photo by Diana Ferrara

experiences working with birds. I offered advice on raising altricial species and we had some lively discussions about enrichment for macaws. This was one of the most inspiring take-aways from my internship, reminding me our animals get the best care when we share information with other institutions and learn from each other.

I learned an enormous amount during my internship at Pinola, and my new vent sexing and pinioning skills have already benefited my team. I am thankful for the San Diego Zoo for allowing me to take this internship opportunity, and for Pinola Conservancy for opening its doors to share its wealth of knowledge garnered through years of experience. 🐢



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